THE American JOURNAL OF Surgery

MARCH 1956

THURSTON SCOTT WELTON, M.D., EDITOR

Review of Chronic Ulcers of Leg

Recurrent Dislocation of Shoulder

Spontaneous Internal Biliary Fistula

SIXTY-FIFTH YEAR OF PUBLICATION

MARCH 1956

THE American JOURNAL OF Surgery

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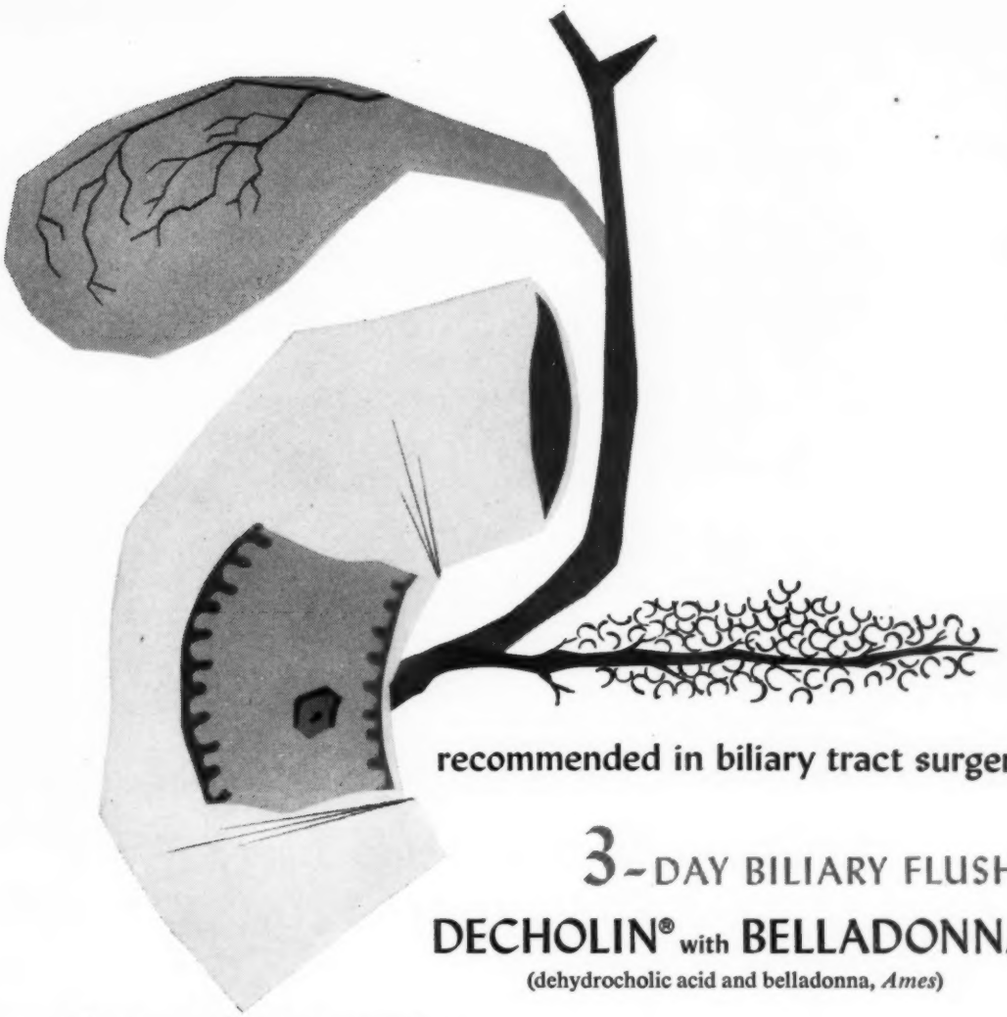

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The American Journal of Surgery is published monthly by The American Journal of Surgery, Inc., 49 West 45th Street, New York 36, N. Y. Yearly Subscription, $15.00 U. S. A.; $16.00 Canada; $17.00 Foreign including Pan-American Countries. Single Numbers $2.00; Special and Symposia Numbers $4.00. Reentered as second class matter February 7, 1951, at the Post Office, New York, N. Y., and on February 7, 1951, at York, Pa., under the Act of March 3, 1879. March, 1956—New Series, Volume 91, No. 3.
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MANUSCRIPTS: All manuscripts should be addressed to the Editorial Office of the Journal, 49 West 45th Street, New York 36, N. Y.

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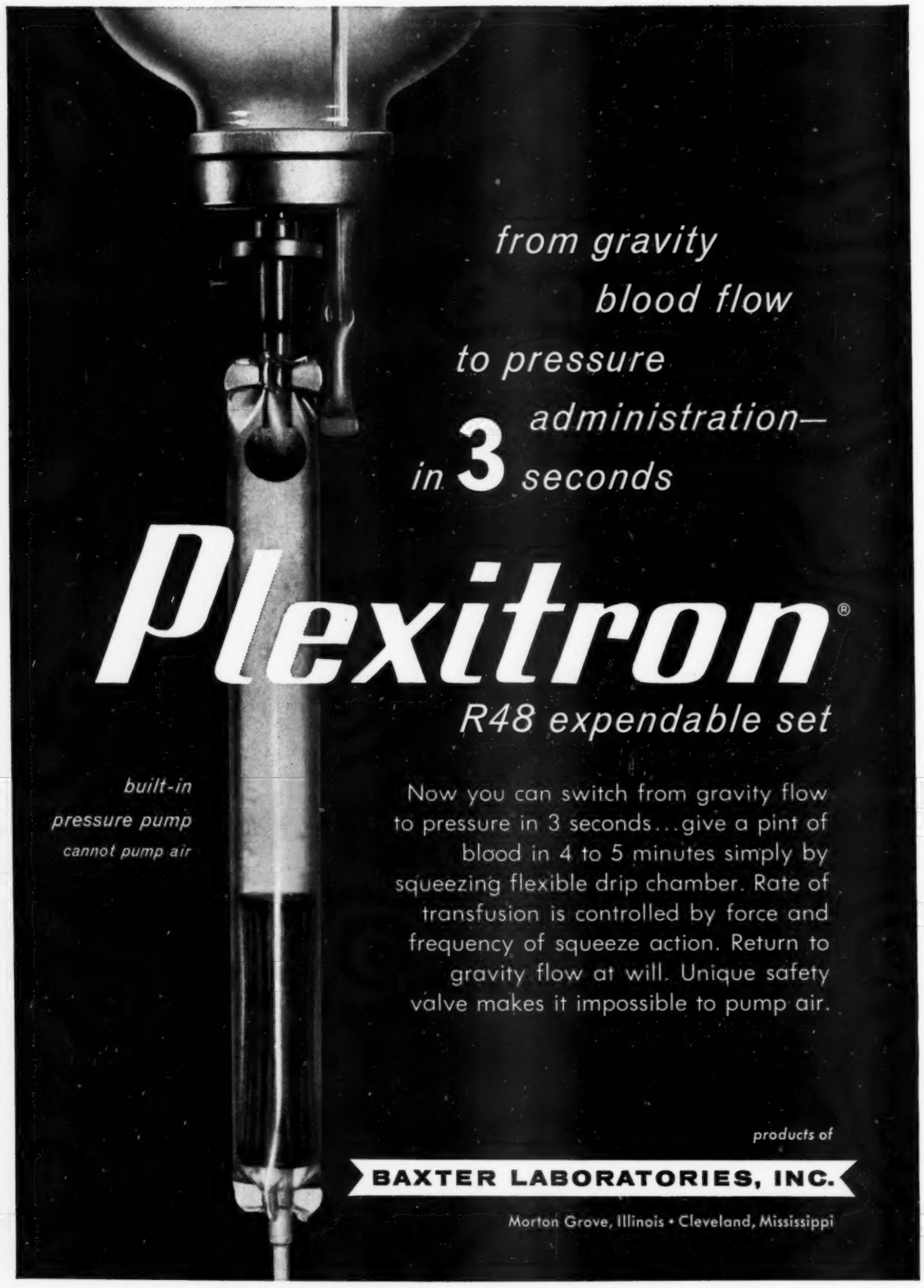
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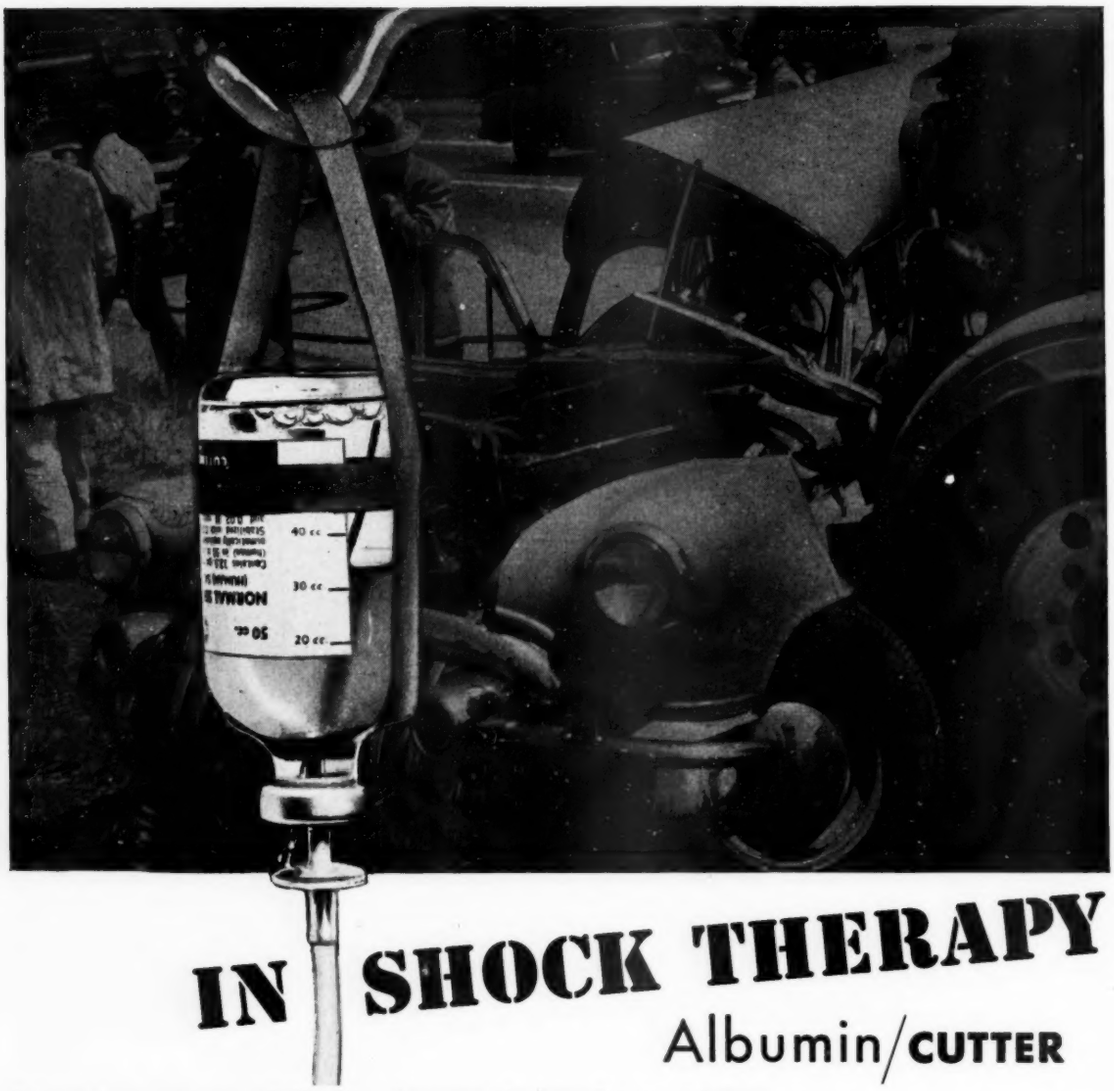

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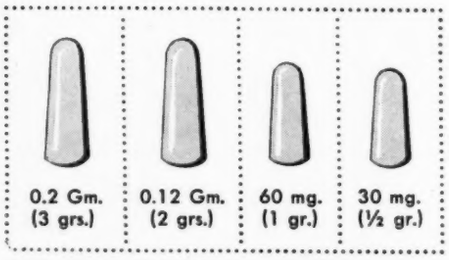

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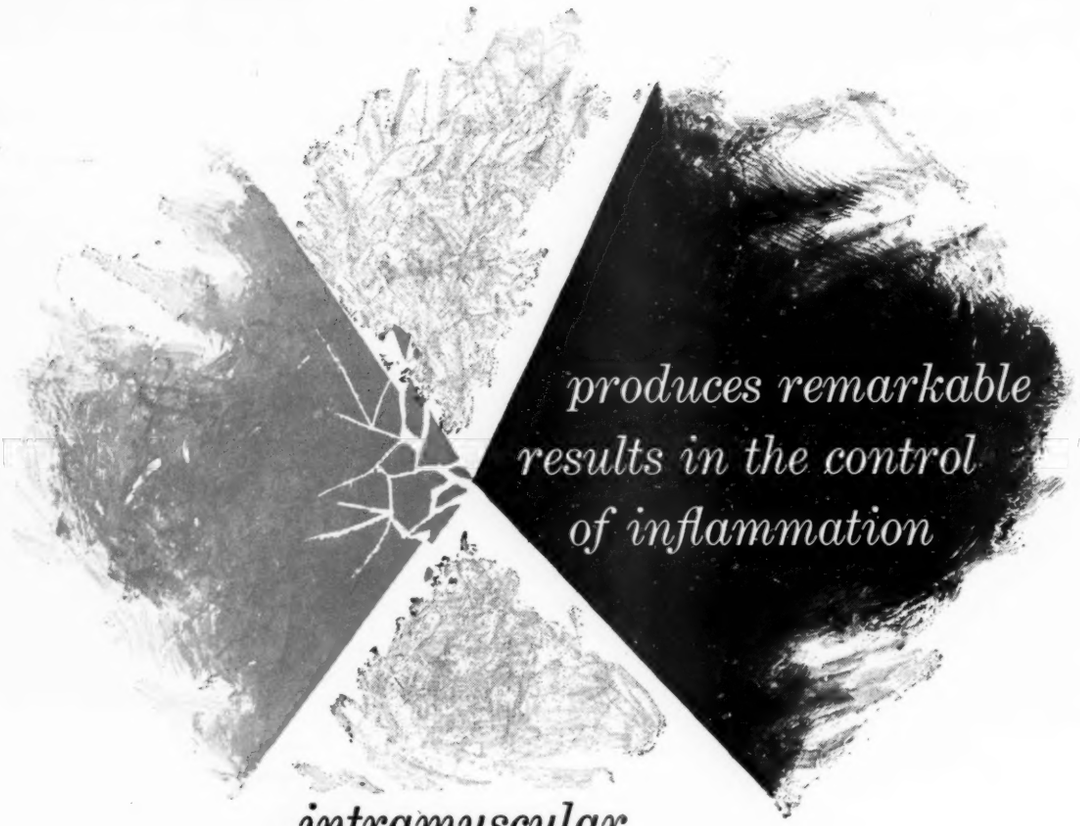

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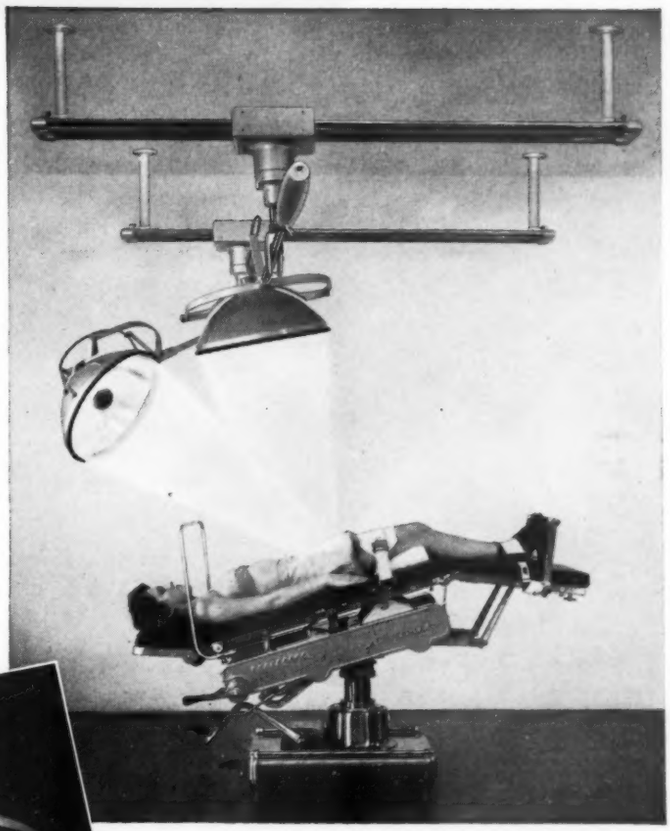

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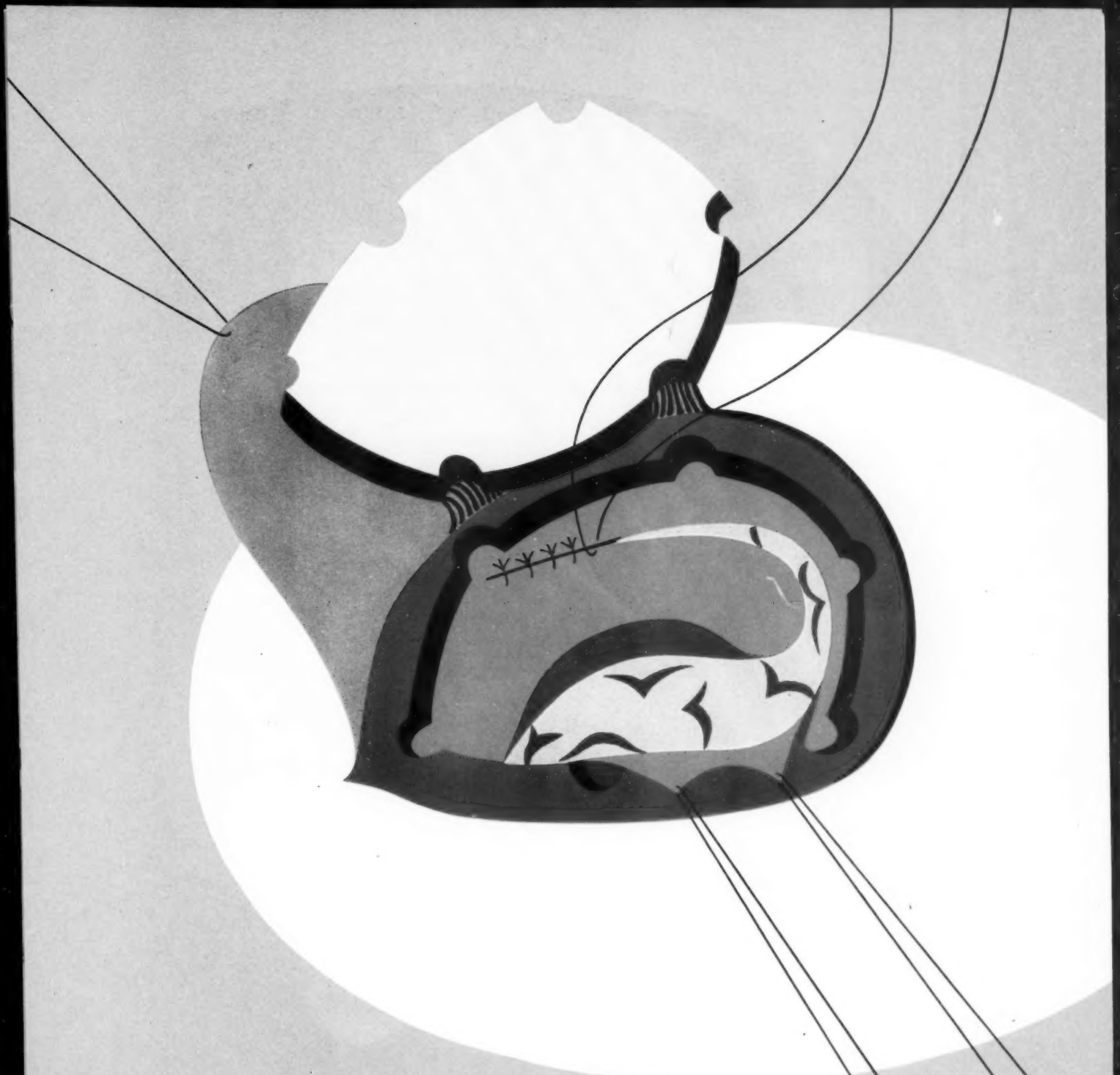

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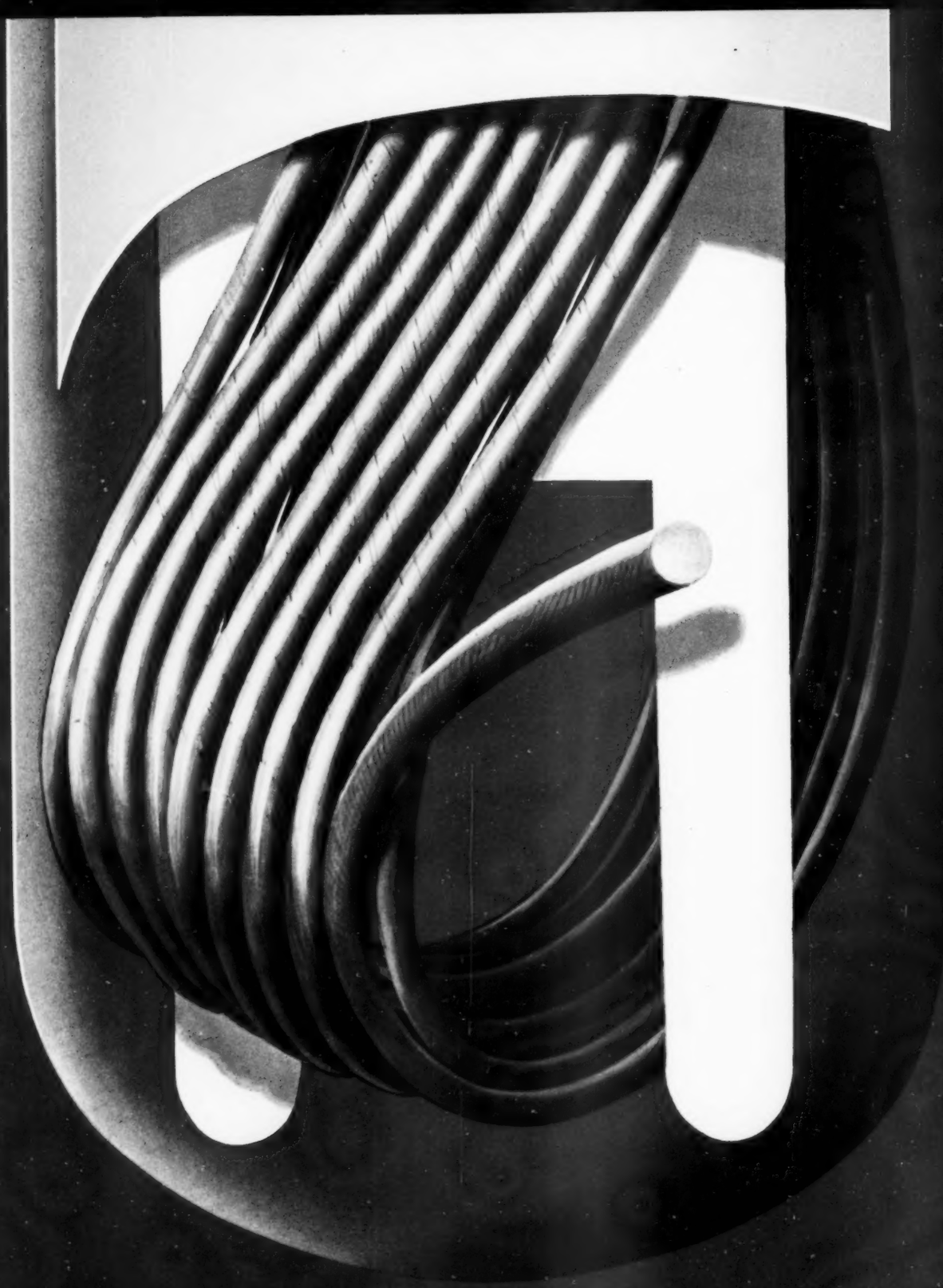

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Pharmacology

Although it is chemically related to epinephrine, Adrenosem Salicylate has no sympathomimetic effects. It does not alter blood components, nor does it affect blood pressure or cardiac rate.[2-7]

Sherber, in an early study,[3] concludes that Adrenosem Salicylate* "is a potent antihemorrhagic factor in those conditions in which the integrity of the smaller vessels is interrupted, and is superior to any similar material that is now available."

He continues, "From our experience it appears that adrenochromazone complex is indicated in preventing vascular accidents incident to hypertension; in maintaining small vessel integrity; in the preoperative preparation where oozing from a vascular bed is anticipated, as in tonsillectomies, adenoidectomies and prostatectomies; and as an adjunct in the treatment of bleeding from such surgical procedures."

Adrenosem Salicylate may be administered simultaneously (but separately) with any type of anesthetic, anticoagulant, or vitamin K and heparin.

A Unique Systemic Hemostat

Clinical investigators[2-7] are in agreement that Adrenosem Salicylate controls bleeding and oozing by decreasing capillary permeability and by promoting the retraction of severed capillary ends. It aids in maintaining normal capillary integrity by direct action on the intercellular "cement" in capillary walls. The interesting work of Fulton[8] confirms this. Adrenosem Salicylate, since it is not a vasoconstrictor, has no effect on large severed blood vessels and arterioles.

Adrenosem Salicylate is being used both prophylactically and therapeutically in thousands of hospitals, and in virtually every type of surgical procedure. It has also proved most useful in dental surgery.[7]

Owings reported on the use of Adrenosem Salicylate in controlling postoperative adenoid bleeding in 102 cases.[4] "We have used 2½ mg.

(* U.S. Patent 2,581,850)

(½ ampule) intramuscularly, 15 minutes before anesthesia for children and 5 mg. (1 ampule) for adults." In only one patient did bleeding occur. Three others showed red blood from the nose and mouth. These patients "were then given 5 mg. intramuscularly, with prompt and complete control. We have also noticed that bleeding stopped more promptly on the operating table."

This is a 1% incidence of postoperative bleeding using Adrenosem Salicylate preoperatively, compared to an incidence of 10% postoperative bleeding in all cases taken from previous records, without Adrenosem Salicylate medication.

Peele reports on the use of Adrenosem Salicylate in treating 178 patients with 24 different conditions.[5] The drug was first used to control postoperative hemorrhage from the adenoid region. He adds: "The results were so dramatic that since that date [1953] Adrenosem Salicylate has been used postoperatively to reduce bleeding from all otolaryngologic and bronchoesophagolic procedures, to treat postoperative hemorrhage from the tonsil and adenoid regions, and to treat selected cases of epistaxis."

The effectiveness of Adrenosem Salicylate in controlling bleeding and oozing in 330 patients is reviewed by Bacala.[6] "Our experience of the effect of carbazochrome salicylate on 317 surgical indications and 13 obstetricogynecological conditions, has been therapeutically encouraging and successful for the control of capillary bleeding. Foremost among the cases studied were 223 tonsillectomies definitely benefited by this metabolic hemostat, making a diminution of the control incidence of post-tonsillectomy bleeding of 19.8% down to 7%. It has also been found useful in gastro-intestinal bleeding, cataract extraction, epistaxis, incisional seepage, trans-urethral prostatectomy, menometrorrhagias, cervical ooze, antepartum and postpartum bleeding, threatened abortion, and prevention of capillary hemorrhages during hedulin or dicumerol therapy."

Side Effects

All investigators concur that, at recommended dosage levels, Adrenosem Salicylate is free from toxic effects. No cumulative effects attributable to the drug have been reported.

The only side reaction noted has been a transient stinging sensation in the area of injection when Adrenosem Salicylate is used intramuscularly. As one investigator comments: "The brief discomfort which attends the injection of Adrenosem into the gluteal region has not been a significant problem in children or adults as originally anticipated."[5]

Indications

Idiopathic purpura, retinal hemorrhage, familial telangiectasia, epistaxis, hemoptysis, hematuria.

Postoperative bleeding associated with:
tonsillectomy, adenoidectomy and nasopharynx surgery;
prostatic and bladder surgery;
uterine bleeding;
postpartum hemorrhage;
dental surgery;
chest surgery and chronic pulmonary bleeding.

Dosage

For recommended dosage schedules, please send for detailed literature.

Supplied

Ampuls: 5 mg., 1 cc. (package of 5).
Tablets: 1 mg. S.C. Orange, bottles of 50.
Tablets: 2.5 mg. S.C. Yellow, bottles of 50.
Syrup: 2.5 mg. per 5 cc. (1 tsp.), 4 ounce bottles.

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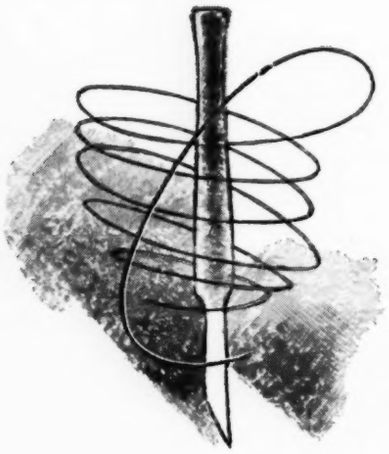

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- delay in wound healing
- susceptibility to infection

Ravdin[1] also suggests that in the absence of frank signs of deficiency it is nevertheless reasonable to assume that deficiency exists whenever illness has been prolonged, particularly in the face of faulty dietary intake.

1. Ravdin, I. S.: Symposium on Nutrition in Surgery, Editorial, Am. J. Clin. Nutrition 3: 447-448 (Nov.-Dec.) 1955.

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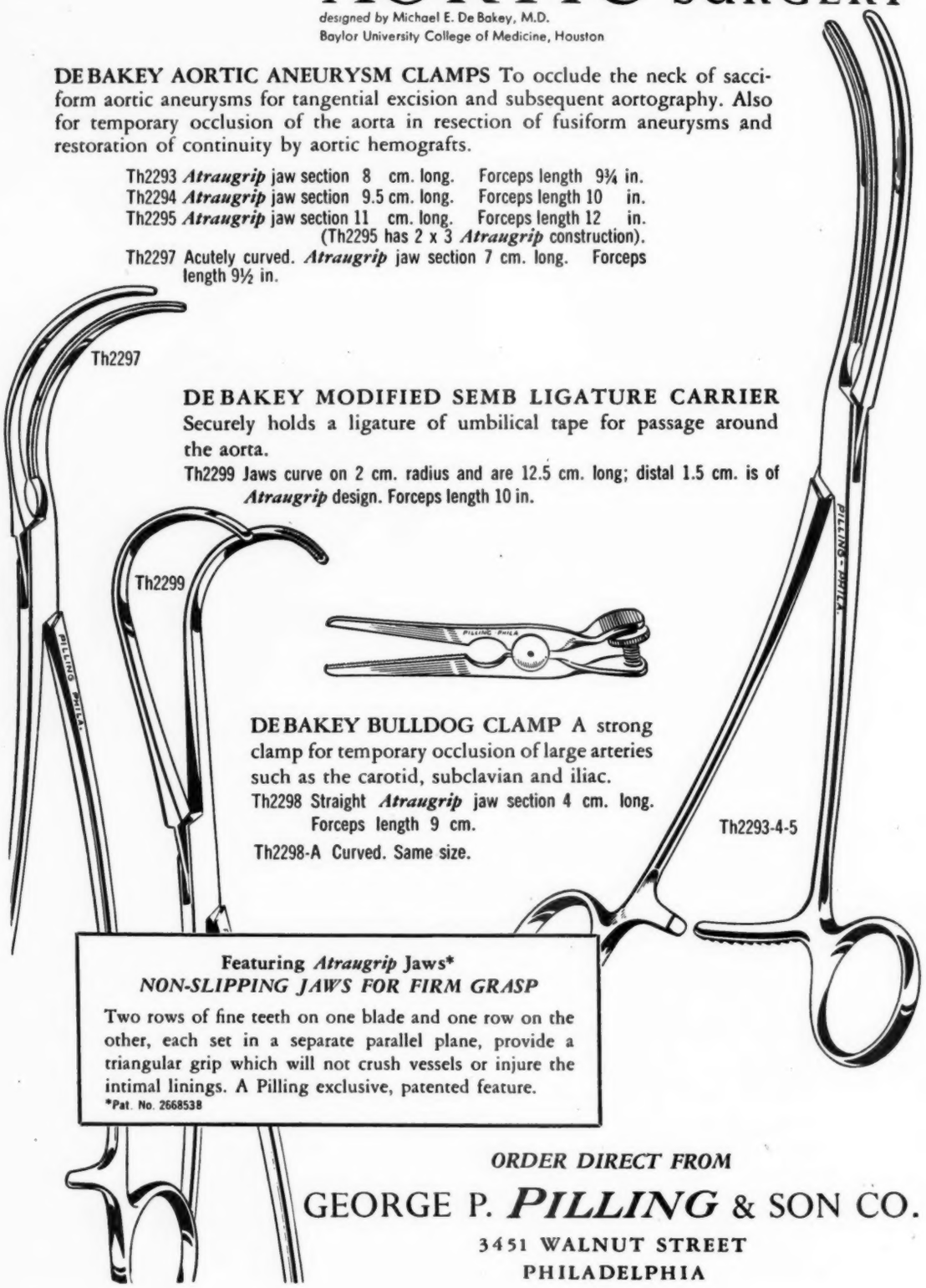

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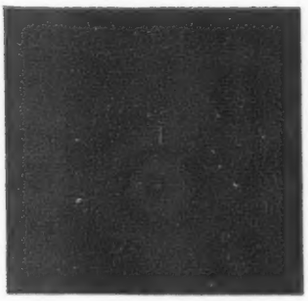

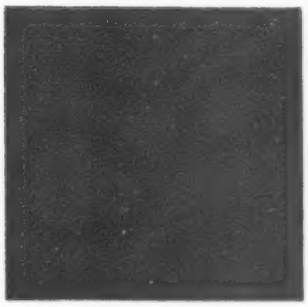

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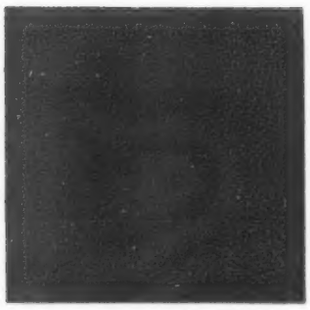

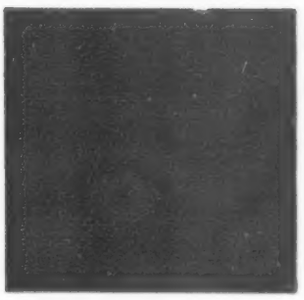

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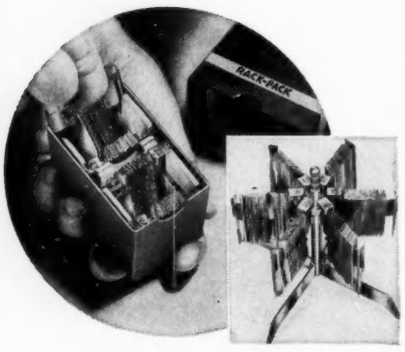

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[1]Whyte, D. W., "Special Indications for Rectal Pentothal in Children." *Canad. Med. J.*, 64:525, June, 1951.

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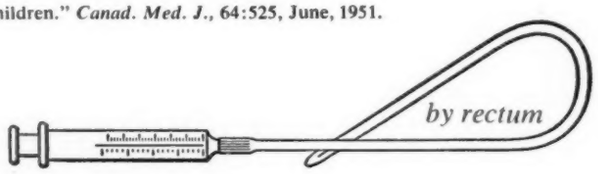

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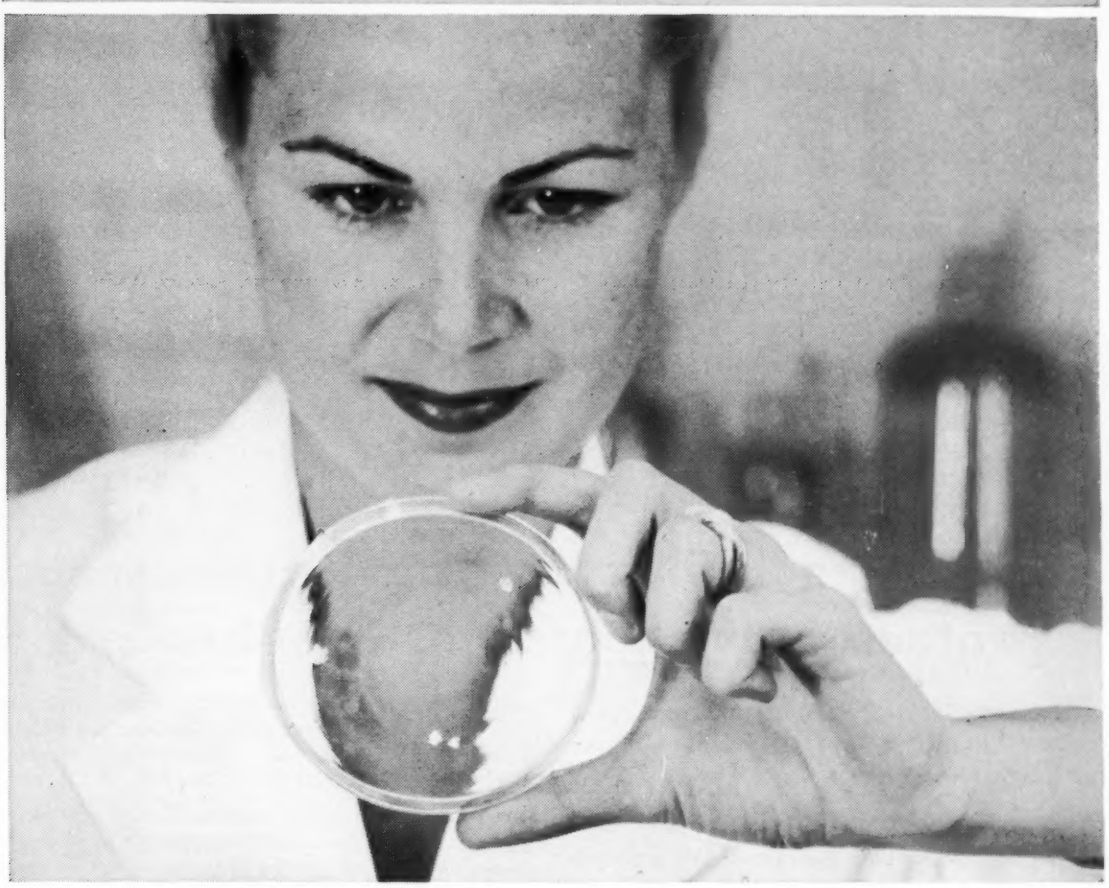

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References: 1. N.N.R. 1954, p. 107. 2. Poth, E. J., J.A.M.A. *153*:1516, December 26, 1953.

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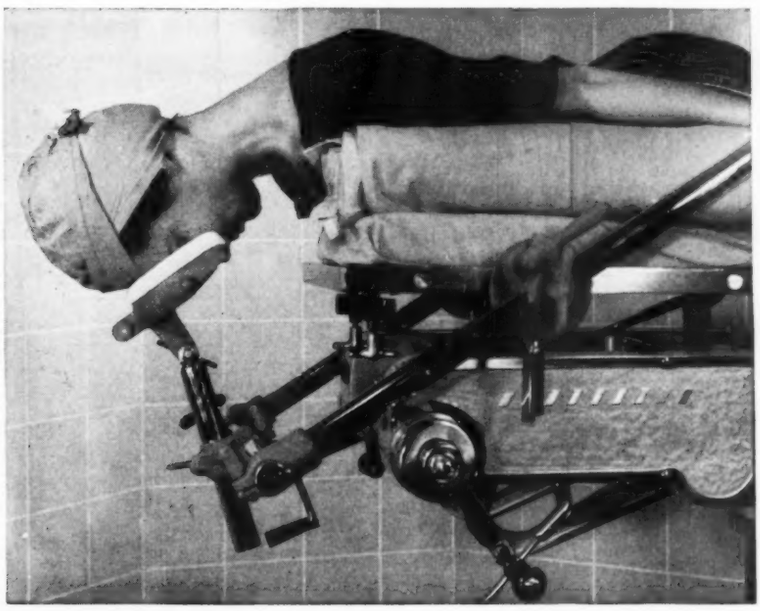

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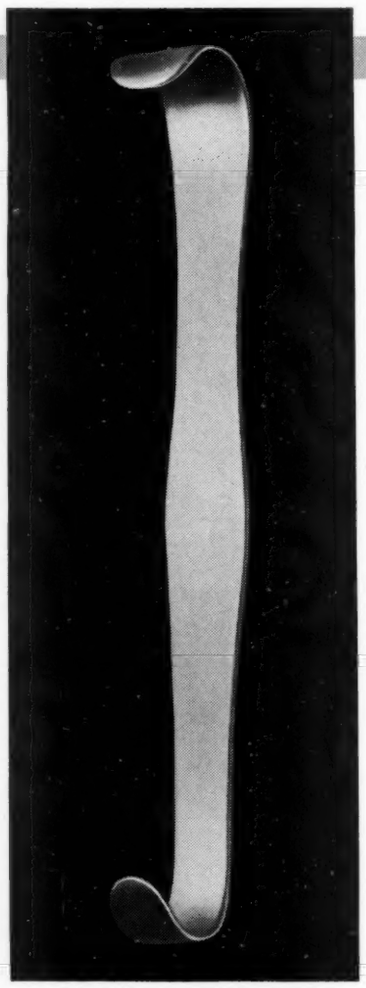

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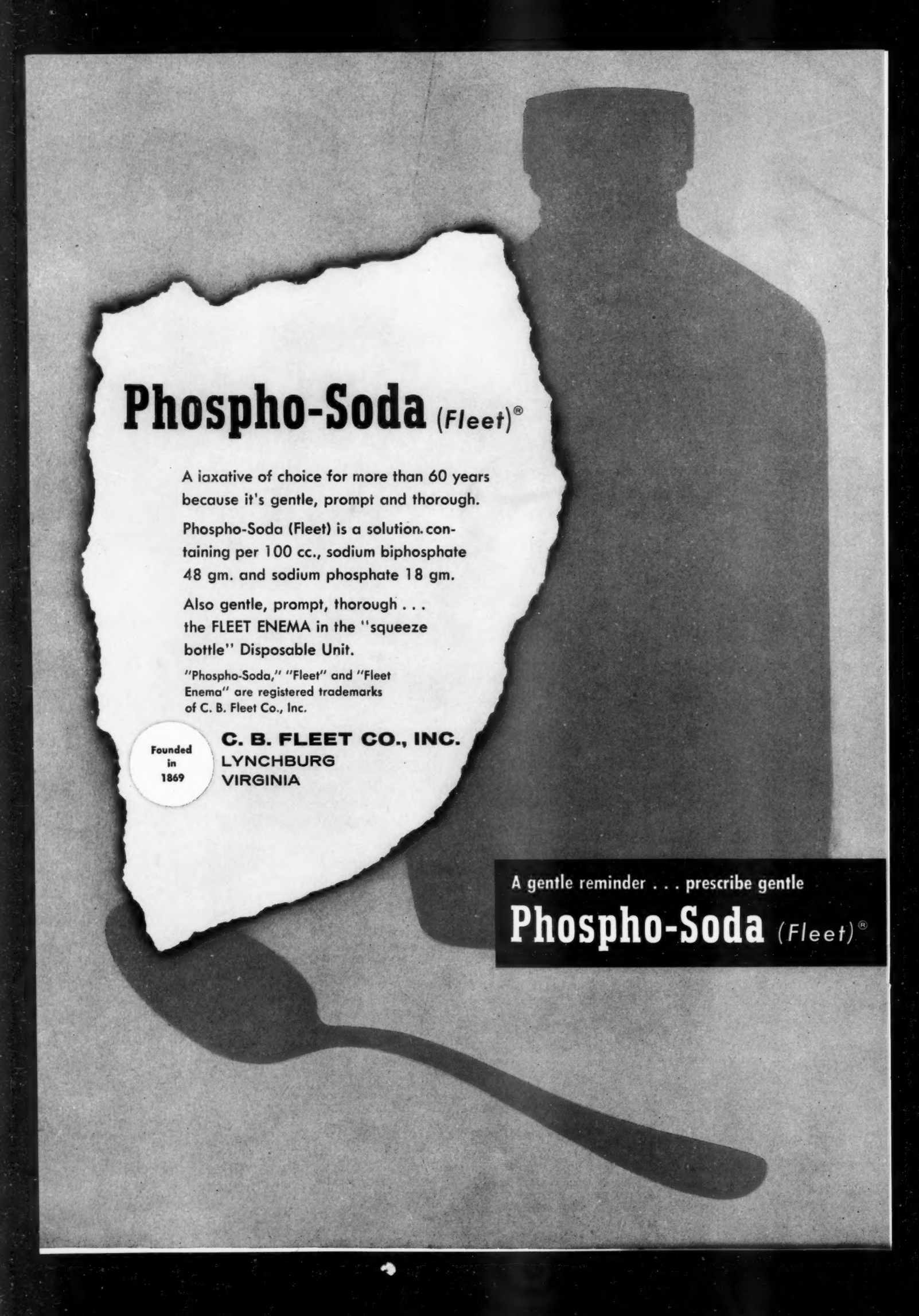
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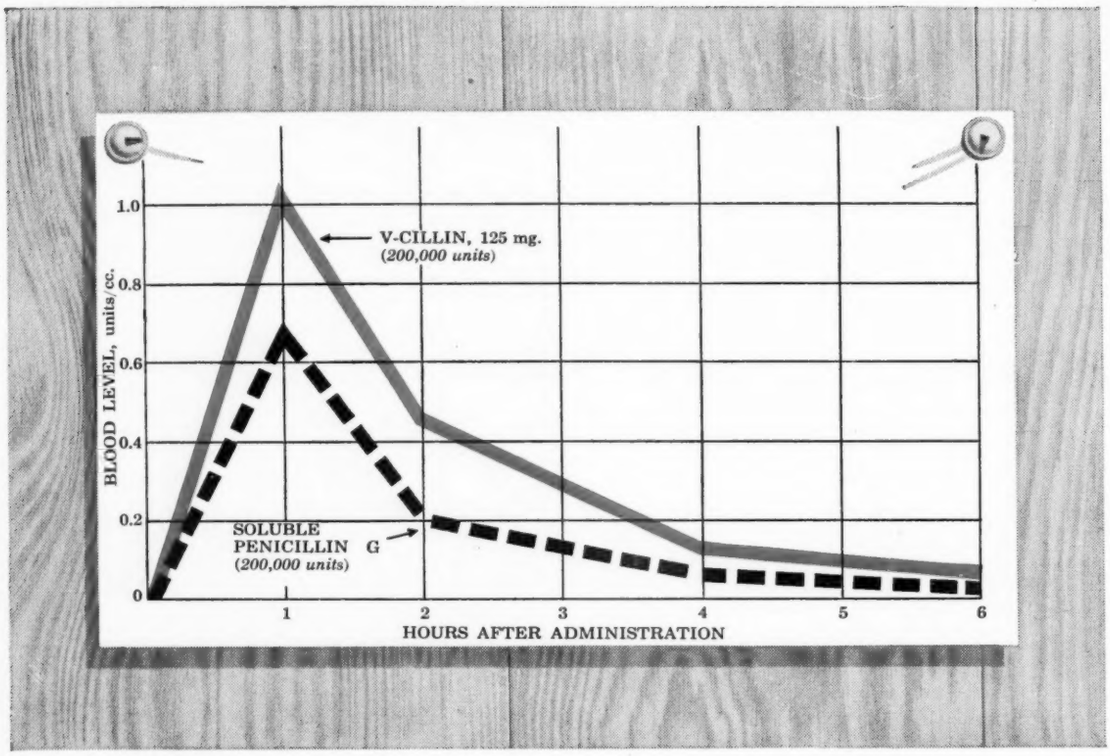

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The American Journal of Surgery

VOL. 91 MARCH 1956 NUMBER THREE

Editorial

SCIENCE AND PHILANTHROPY

IT is not an exaggeration to say that the average person gives little thought to the costs of medical education and scientific research. Also, he is not concerned with the source of support for these programs. The intelligentsia know that the basic sciences are taught in most colleges and that medical research goes on in college and pharmaceutical laboratories, government agencies, etc. It may be surmised that businessmen who have amassed riches give generously that this work may continue. Unfortunately these business giants, for the most part, insist or stipulate that a cure be the end result of this spending. Not in their prospectus are the hundred-odd basic problems which must be solved before a "cure" is within the realm of certainty. The average person gives only a sort of pseudo-concern, if even that, to the fact that those in charge of our medical schools and the many scientific centers spend restless nights burdened with the obligation of making ends meet and keeping within a budget.

Thus it was exciting to read recently that the Commonwealth Fund gave eight million dollars to various medical colleges (ten institutions). No strings were attached to these grants; the receivers can do with the gift as they wish. The Commonwealth Fund dipped into their principal to meet this need. It is said that "the medical college is the headache of the university." Knowing the dire needs of present day medical schools, this unusual and generous gift opens up a new vista in Foundation giving. Business corporations also (including many pharmaceutical concerns) have given millions of dollars for medical education. If these sources of assistance continue and increase, our medical schools will function and will produce in numbers and quality the future physicians of our country.

This should not be an idle dream, for last year our country set a record in philanthrophic giving—an estimated $5,400,000,000, according to the American Association of Fund Raising Counsel. In 1922 the per capita average was $9.46; last year it was $33.25. Of this sum, religious organizations receive slightly over half. However, the Twentieth Century Fund Foundation reports that the average church member contributes $.32 a week to his church. Hospitals and health contributions rank third, at 10.4 per cent.

Raising and contributing money for scientific works is an intricate and complicated business. If one wishes to know more about medical research and discovery, the source of money, where it goes and for what, accomplishments and problems still to be solved, we suggest he consult the recently published "Medical Research: A Midcentury Survey," Volume 1: American medical research in principle and practice, page 765, and Volume 2: Unsolved clinical problems in biological perspective, page 740. (Edited by Esther Everett Lape and associates. Published for the American Foundation by Little, Brown & Co., Boston.)

This survey investigates medical research and its findings, which sometimes meet great delay in publication. For example, Waldemar Kaempffert in reviewing the book in the *New York Times*, says: "There is truth in the saying that it takes ten years to get a new and approved medical discovery into a textbook and ten years to get it out when it has been superseded. When Fleming published his discovery of penicillin in 1929, he suggested that its

remarkable antibiotic properties be clinically studied. Ten years passed before a group headed by Sir Howard Florey heeded the suggestion. When it was heeded, penicillin was introduced in two years. Scores of such failures to follow up important clues can be culled from medical history."

The press is doing outstanding work in educating and keeping the public informed of the many advances being made in medical research. This is also true of the Atomic Energy Commission, the United States Health Service, the Foundations and other agencies. Let us hope that the medical profession will become familiar with the many facets of the problems of medical research, and as a result will be better able to carry on and attain that scientific goal all of us hope for and seek.

T.S.W.

LETTER TO THE EDITOR

In the October, 1955 issue of *The American Journal of Surgery* Dr. Louis Sachs, under "Practical Surgical Suggestions," proposes a vertical suture for closure of the peritoneum in difficult cases in order to prevent cutting through the transverse musculature resulting in future hernias and even eviscerations. Although such a method will no doubt minimize the occurrence of those accidents, an element of weakness cannot be entirely eliminated since part of the suture is still in a transverse direction and is just as liable to cut through, even though not to the same extent.

The through and through interrupted heavy silk suture offers a better solution to this problem. Apparently it is not well known or not known at all. I have used this method for the closure of abdominal incisions for many years in hundreds of cases with most satisfactory results. The proper way to apply it is to use a large surgical needle and start approximately 1 cm. from the edge of the skin wound on one side, going through all the abdominal layers down through the peritoneum, and then reverse and go through peritoneum and all the other layers of the abdominal wall, emerging approximately 1 cm. from the edge of the skin wound on the other side. The sutures are placed approximately 1 cm. apart and there is no need for any additional skin sutures. These sutures are not tied until they are all in, at which time they are tied tightly with double surgical knots.

It should be emphasized that these are through and through sutures and not the crossed figure-of-8 sutures as used by some surgeons. The latter method defeats the purpose, as it has this foreign body in between the wound surfaces. The effectiveness of the through and through suture, I think, is due to the fact that it holds the peritoneal surfaces together long enough for agglutination to take place and no evisceration is then likely to occur. Evisceration has never occurred while I have been using this suture.

There is slight edema of the skin in about forty-eight hours but this subsides rapidly in the next few days and the wound assumes a perfectly normal, healthy appearance.

The sutures are left in for approximately ten or twelve days when they begin to appear somewhat loose and are then cut. However, the sutures are not removed until the next dressing when many of them will be found loose in the dressings and the rest can be readily pulled out without the slightest pain to the patient.

This type of suture is not original with me. Many years ago I observed its use by Dr. Kennedy of the Joseph D. Price Hospital in Philadelphia and also the late Dr. A. A. Berg of the Mt. Sinai Hospital, New York. Dr. Kennedy used silkworm suture while Dr. Berg used heavy silk. I prefer heavy silk (deknatel) because silkworm suture breaks occasionally when a surgical knot is being tied.

It has been my practice to use this type of suture in all cases of cancer, without exception, whether in upper or lower abdominal incisions, and also in the case of patients whose general condition was below par. Some of these patients, I believe, lack the agglutinative factor of the peritoneal surfaces; and when one observes some peritoneal fluid escaping between the sutures, that to the experienced surgeon is the first danger signal of possible evisceration.

It takes a little longer to close the abdomen by this method but it saves a lot of trouble later.

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Treatment of Spontaneous Internal Biliary Fistula Caused by Duodenal Ulcer

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SPONTANEOUS internal biliary fistula occurs frequently between the extrahepatic biliary system and the gastrointestinal tract. The most common, the cholecystoduodenal fistula, is caused by passage of gallstones directly from the gallbladder into the duodenum. The less common choledochoduodenal fistula, which in the best documented series[6,9] comprises about 3.5 per cent, is usually due to erosion of a duodenal ulcer into the common bile duct. Fistula between the common duct and duodenum caused by calculous biliary tract disease is exceedingly rare. The anatomic proximity of a distended gallbladder to the second part of the duodenum probably accounts for the high incidence of fistulas between these two organs in cholecystic disease. Similarly, the proximity of the first portion of the duodenum to the common duct as it courses in the hepatoduodenal ligament may account for the association of duodenal ulcer with fistula into the common duct.

Although roentgenograms provide the most reliable information concerning the type of fistula that is present, an accurate anatomic diagnosis is often difficult. In 1925 Judd and Burden[12] reported 153 cases of internal biliary fistulas treated surgically. A correct diagnosis was made preoperatively in only two cases. In a later report by Epperson and Walters,[9] roentgenographic studies were performed in forty-two of the eighty-four cases. This method was accurate in 26 per cent of the cases. (All three of the choledochoduodenal fistulas in this group were correctly diagnosed.) In those cases studied without roentgenograms, the correct diagnosis was made in only 10 per cent.

Gas in the bile ducts is a reliable sign of a pathologic connection between the biliary system and the gastrointestinal tract although the presence of barium provides more definite information as to the specific type of pathology.[4] The distinction between various types of fistulas is primarily based upon the position of the barium-filled fistula in relation to the gastrointestinal tract and the location of the mucous membrane changes. An accumulation of contrast medium to the right of the duodenum without extensive filling of the intrahepatic ducts suggests a cholecystoduodenal fistula. In choledochoduodenal fistula, the upper portion of the common duct is filled with barium which extends directly from the duodenum. (Figs. 1A and 2A.) This is followed by filling of the cystic and hepatic ducts and possibly the gallbladder itself. The roentgenogram produced by regurgitation of contrast medium through a dilated or patulous ampulla of Vater should not be confused with that produced by choledochoduodenal fistula. In the former case, barium enters the common duct at the ampulla and is seen medial to the mid-portion of the second part of the duodenum about 10 cm. from the pylorus. Differentiation may be difficult in the case of a true fistula near the ampulla. In this instance some of the intrahepatic biliary tree is usually visualized (Figs. 1B and 2B) while in reflux through the ampulla this rarely occurs since only the distal portion of the common duct or ampulla itself is filled.[11]

The low incidence of choledochoduodenal fistula is reflected by the small number of proved cases reported. Koberle[13] in 1938 found eight cases in the literature in which diagnosis was proved by surgery or autopsy, and added

two cases of his own. In 1953 Cogbill[5] found eight additional cases and added two of his own, bringing the total to twenty. Since then there have been several reports, each consisting of two to three cases. Although choledochoduodenal fistula is relatively uncommon, every effort should be made to differentiate it from cholecystoduodenal fistula. Since the former is usually caused by ulcer and the latter by calculous disease of the gallbladder, the differential diagnosis is important for establishing prognosis and recommending therapy.

The prognosis of a cholecystoduodenal fistula secondary to gallstone ulceration is potentially poor. The gallbladder is always diseased, and is usually small and contracted. It may contain foul bile, pus, stones and/or duodenal contents. Judd[12] found stones in the gallbladder or common duct in 121 of 153 cases of internal biliary fistulas. For the fistula to remain open, the common duct must be obstructed and the cystic duct patent. These fistulas rarely provide adequate biliary drainage because scar formation and contracture of the fistulous lumen begins almost as soon as the communication is established. Relief of symptoms following the formation of a fistula is temporary at best. The complications which result from "cure" by fistulous formation may be more serious than the original disease. Since this condition is a complication of long-standing cholecystitis and cholelithiasis, the morbidity and mortality are understandably high. In Judd's series sixteen of 153 patients died. In a report of 500 operations upon the biliary tract, Puestow[17] noted sixteen fistulas, none of which were the result of duodenal ulcer. All of his patients were seriously ill and experienced no relief of symptoms following the formation of fistulas. He reported a mortality rate of 19 per cent and a high morbidity due to damage of the liver by inadequate drainage of intestinal contents that had regurgitated through the fistula. The prognosis in cases with fistulas secondary to gallstone ulceration is also potentially poor because stones in such cases may obstruct or perforate other portions of the gastrointestinal tract. Dean[6] reported an incidence of fistulas in 1.2 per cent (twenty-nine) of those cases with cholecystic disease. Five of the fifteen deaths in this group were due to intestinal obstruction by biliary calculi.

On the other hand, the prognosis of a choledochoduodenal fistula, which is almost always secondary to duodenal ulcer, is substantially better than that for cholecystoduodenal fistula. Although verification of this rare type of fistula by surgery or autopsy is uncommon, infrequent reference to cholangitis has been noticeable in the cases reported. It is believed that absence of hepatic infection contributes to the low morbidity and mortality in this type of fistula particularly when surgery is indicated.

Differential diagnosis of the type of internal biliary fistula is also important from the standpoint of treatment. It is generally conceded that the treatment for internal fistula secondary to gallbladder disease is removal of the gallbladder and any ancillary procedure necessary to eliminate cholecystic disease. Because of the poor prognosis of cholecystoduodenal fistula, some surgeons consider choledochoduodenal fistula equally dangerous and, therefore, recommend prophylactic surgery to prevent hepatitis regardless of the patient's clinical status. Since the literature reveals that hepatitis is an uncommon complication of the latter[2,4–6,13,20] reflux of barium does not have the serious connotation that it does when seen in cholecystoduodenal fistula. Rational management of fistulas caused by penetrating duodenal ulcers should not be based on anticipated complications usually seen in fistulas secondary to gallbladder disease. Indications for surgical management in the former cases should be limited to complications of peptic ulcer such as bleeding, obstruction, perforation, intractable pain and to cases in which evidence is available that cholangitis is or has been present.

Cases of long-term choledochoduodenal fistulas without evidence of cholangitis have been described. Our two case reports illustrate proved choledochoduodenal fistulas through which there had been reflux for at least one year without evidence of cholangitis; in one case good presumptive evidence is available that the fistula was present for a longer period.

Since internal biliary fistula caused by duodenal ulcer is uncommon, little precedence exists to indicate the treatment of choice. Because of complications which occur with cholecystoduodenal fistula, it was thought that surgery was indicated in these cases to prevent the development of cholangitis. Subsequent study of this problem strongly suggests that prophylactic surgery for the prevention of

cholangitis is unjustified for choledochoduodenal fistula secondary to duodenal ulcer.

CASE REPORTS

CASE 1. F. B., a seventy-three year old white man, was admitted on February 23, 1954. Six weeks prior to admission the patient "fainted" without premonitory signs or symptoms. He regained consciousness within five to ten minutes. There was no associated pain, nausea or vomiting. Following this episode of weakness and anorexia, the patient remained in bed for one week. No blood was noted in his stools. His appetite returned and he regained weight. Previous to admission roentgenograms of the upper gastrointestinal tract revealed barium in the intra- and extrahepatic biliary tree. (Figs. 1A and B.) He was referred to our hospital with the diagnosis of internal biliary fistula. Past history revealed treatment for a duodenal ulcer from 1906 to 1919 but no gastrointestinal symptoms suggestive of peptic ulcer had been present for twenty years.

Laboratory findings were as follows: Red and white blood cell counts and urinalysis were normal. Liver function studies revealed bromsulphalein, 4 per cent retention in forty-five minutes; icteric index 3 units; van den Bergh test 0.3 mg. per cent; thymol turbidity 7.7 units; and cephalin flocculation negative. The gallbladder was not seen on the roentgenograms made following administration of priodax.®

On admission the patient was asymptomatic and remained so. Because of roentgenographic evidence of an internal biliary fistula, surgery was recommended. Laparotomy was performed on March 18, 1954, and revealed a normal-appearing gallbladder and liver. The significant findings were limited to the first portion of the duodenum where an area of dense scar tissue was found between the posterior aspect of the duodenum and the common duct. In view of the patient's age and lack of symptoms referable to the ulcer or fistula, it was thought that the risk imposed by these findings contraindicated definitive surgery. Gastroenterostomy was performed and an uneventful recovery resulted. When seen one year later the patient was in good health, notwithstanding roentgenographic evidence of reflux of barium into the choledochoduodenal fistula in a manner similar to that seen prior to surgery.

Comment. This case represents an internal biliary fistula which was discovered on routine

FIG. 1A. Case 1. Roentgenogram of upper gastrointestinal tract demonstrating a choledochoduodenal fistula. The upper portion of the common duct is filled with barium which extends directly from the first portion of the duodenum.

FIG. 1B. Case 1. Roentgenogram of upper gastrointestinal tract demonstrating a choledochoduodenal fistula. Filling of the intrahepatic biliary tree with barium is seen.

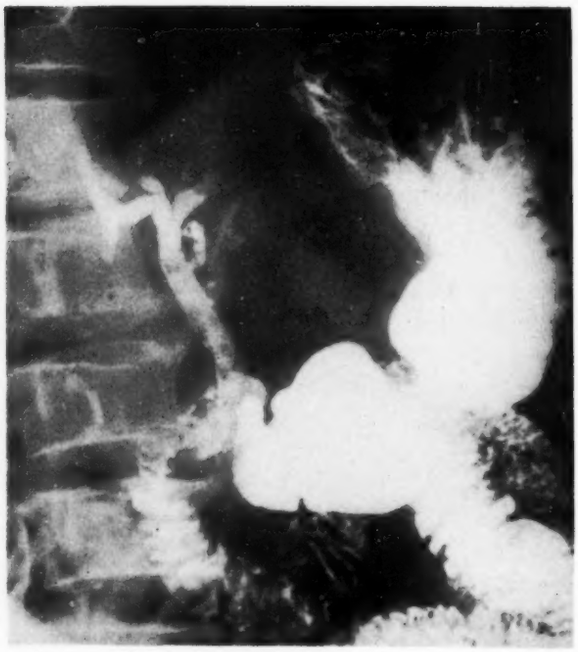

FIG. 2A. Case II. Roentgenogram demonstrating the choledochoduodenal fistula. The common duct is filled with barium which extends directly from the first portion of the duodenum.

FIG. 2B. Case II. Roentgenogram demonstrating the choledochoduodenal fistula. Extensive filling of the intrahepatic biliary tree with barium is demonstrated.

roentgenographic examination of the gastrointestinal tract. From this study it is clear that the fistulous communication which existed between the common duct and duodenum represented a choledochoduodenal fistula secondary to a duodenal ulcer. From the patient's history it might be inferred that the ulcer had been inactive for twenty years and that the fistula had been present for that period without evidence of cholangitis. Gastroenterostomy has been reported elsewhere as treatment for this type of fistula when gastric resection is too difficult.[14] However, visualization of barium in the common duct one year following operation demonstrates that gastroenterostomy did not prevent reflux of gastrointestinal contents into the biliary system. At the same time there was no evidence to suggest the presence of cholangitis. This case supports our view that surgery is not justified for prevention of cholangitis if the latter has never been present.

CASE II. V. C., a fifty-eight year old white man, had experienced gastrointestinal symptoms suggestive of peptic ulcer for thirteen years. For two years prior to admission on May 18, 1954, the patient complained of periodic mid-epigastric pain which was relieved by soda or milk. He stated that his pain increased when lying down and improved when standing. During hospitalization his symptoms were relieved by antacid therapy. Past history revealed no episodes of jaundice.

Laboratory findings were as follows: Roentgenographic examination of the gastrointestinal tract revealed a duodenal ulcer and a choledochoduodenal fistula. (Figs. 2A and B.) A gastric analysis revealed 116 degrees of total acid and 63 degrees of free acid. Urine was normal. Serology was negative. The white blood cell count was 10,800 and the differential white count was normal. Cephalin flocculation was 1+ in twenty-four hours, 3+ in forty-eight hours. Thymol turbidity was 2.4 units, bromsulphalein was 0 in forty-five minutes. At operation on August 10, 1954, an ulcer on the posterior wall of the duodenum was demonstrated. There was extensive induration into the pancreas and the region of the distal common duct, but the liver and gallbladder were normal. Vagotomy, partial gastric resection and Billroth II anastomosis were performed. Postoperatively giant urticaria developed followed by exfoliative dermatitis after administration of penicillin. On the fifteenth postoperative day the patient's wound dehisced

and required secondary closure. Prior to discharge, roentgenographic examination of the gastrointestinal tract revealed air in the biliary tree but no reflux of barium. When the patient was seen six months postoperatively his only complaint was partial inability to eat because of a feeling of fullness associated with faintness and weakness. This complaint, however, was beginning to diminish in severity.

Comment. One year prior to admission roentgenograms of the gastrointestinal tract revealed a choledochoduodenal fistula. At no time during this period was there any clinical evidence or liver function abnormality to suggest cholangitis. In addition, the patient's ulcer symptoms were controlled by rigid medical management. Operation was advised in order to prevent the development of cholangitis. The evidence presented suggests that surgical management based on this assumption was unjustified since the probability of cholangitis as a complication was insignificant.

COMMENTS

The presumption that reflux of gastrointestinal contents into the common duct would produce cholangitis was the justification for surgical treatment in the two cases discussed. This concept was, in turn, based on two facts: (1) internal biliary fistulas secondary to gallbladder disease are beset with many complications including cholangitis; and (2) common duct reconstruction operations for strictures and sidetracking operations for biliary obstruction are associated with a high incidence of ascending cholangitis and hepatitis. Evidence suggests that the causes for cholangitis in these two instances do not apply to choledochoduodenal fistula produced by a penetrating duodenal ulcer. Cogbill[5] reported two cases of choledochoduodenal fistulas in patients with histories of peptic ulcer of approximately five years' duration. One patient underwent gastric resection and the other vagotomy and gastroenterostomy. No suggestion of cholangitis was noted in the ulcer histories or during the follow-up periods. Walker and Large[20] reported two cases of choledochoduodenal fistulas in patients with histories of peptic ulcer for twenty years and eight years, respectively. In both cases gastric resections were performed for "intractable pain." Liver function studies and liver biopsies were normal. There was no past history in either case to suggest cholangitis. While reviewing this subject and presenting his own case, Koberle[13] emphasized the rare occurrence of ascending cholangitis in cases of choledochoduodenal fistula formed by peptic ulcer. Beekhuis[2] reported a case of this type in which the patient lacked evidence of cholangitis, and he stated that infection of the liver is not to be expected because of the adequate drainage of the biliary tract into the intestine.

Waggoner and Le Monde[19] reviewed 819 cases of internal biliary fistula diagnosed by roentgenographic study but unverified by operation. They found that 19 per cent were choledochoduodenal fistulas. Their incidence rate for this type of fistula is considerably higher than that reported in series in which the fistulas were verified by operation. The greater incidence found in this series might be a reflection of the number of such cases that are not treated surgically. If cholangitis were a significant complication, it would seem logical to expect in the cumulative reports frequent reference to its presence as the factor responsible for or complicating the surgery in cases of choledochoduodenal fistulas.

The cause of cholangitis which develops following bilio-alimentary anastomoses for treatment of obstruction of the biliary tract or reconstruction of the common duct is controversial. The basis for this controversy is whether "reflux" of gastrointestinal contents in the biliary tree or inadequate drainage of the biliary tree due to stricture formation is responsible for the cholangitis.

Finsterer,[10] Bernhard[3] and Du Bose[7] reported favorable clinical results following choledochoduodenal anastomoses. Wangensteen[22] in 1928 presented this concept: "Probably only in the event of obstruction to the flow of bile through the new stoma does the potential infection in the bowel become a menace." Oettle[15] had a similar opinion and believed that the anastomosis of the biliary tree to the gastrointestinal tract must be wide. Wide anastomosis affords easy filling and emptying of the biliary passages, thereby preventing infection because the unhindered biliary drainage guarantees prompt elimination of invading bacteria. Eliasion[8] concluded that the frequency of ascending infection as a complication was not great enough to discard the operation of biliary intestinal anastomosis. In an experimental study Bachrach[1] showed that if the anastomotic opening of the common duct to the gastrointestinal tract remained persistently patent with a sufficiently large orifice giving adequate

drainage, minimum stasis with limited ascending infection and insignificant pathological changes of the liver resulted.

Peterson and Cole[16] thought that reflux of gastrointestinal contents following bilio-alimentary anastomoses was commonly present, but that associated infection was not present to a detrimental degree in the majority of instances. In most cases infection resulting from such an anastomosis was due to stricture formation at the anastomotic site. They reported two cases, however, in which the infection did result from reflux. In each case a loop of jejunum had been anastomosed to the hepatic duct at the hilus of the liver. The authors were convinced that regurgitation of gastrointestinal contents into the hepatic duct was capable of producing an infection of the suppurative cholangitis type, although it had not been encountered when at least 2 to 3 cm. of common hepatic duct were available for anastomosis with the intestine. In two cases of suppurative cholangitis following the anastomosis of a sizable stump of hepatic duct to the intestine, strictures, which were the obvious cause of the infection, were found to be present.

In 1946 Zaslow and Counseller[23] stated that cholangitis was most likely to follow sidetracking operations of the biliary tract if there had been no infection preoperatively, while cholangitis, existing prior to surgery, was likely to subside after operation. These authors believed that since there was no greater reason for stricture to form postoperatively in patients without cholangitis than in those with cholangitis, regurgitation must be the etiologic factor causing infection following sidetracking operations.

Walters,[21] reporting from the same clinic in 1954, stated that he used biliary duodenal anastomoses for all stricture repairs. He remarked that regurgitation was unimportant and that hepatic infection occurred following this type of repair only when the anastomosis had contracted and become obstructed. Although cholangitis due to regurgitation is a possibility in choledochoduodenal fistula, it appears that stricture rather than reflux is the important factor in the development of this complication.

CONCLUSIONS

A review of the literature on spontaneous internal biliary fistulas indicates that erosion of a duodenal ulcer into the common bile duct is the most common etiologic factor responsible for choledochoduodenal fistula, while cholecystic disease is the cause of cholecystoduodenal fistula. The difference in prognosis of the two types of fistulas make it important that an accurate diagnosis be established. Roentgenographic studies together with associated signs and symptoms should make the diagnosis evident.

In contrast to the high incidence of hepatic infection in patients with fistulas due to cholecystic disease, infection of the liver as evidenced either clinically or by liver biopsy is rare in choledochoduodenal fistulas produced by penetrating duodenal ulcers. Reports disclose that several patients with proved choledochoduodenal fistulas experienced ulcer symptoms for a number of years, and it may be reasonable to assume that in some of these cases unrecognized fistulas had been present without evidence of cholangitis. Of the two cases presented, the first patient may have had a fistula for some time prior to surgery but it is certain that reflux continued one year after gastroenterostomy without subsequent cholangitis. The second patient was also known to have reflux into the common duct without cholangitis for one year and perhaps longer prior to operation.

Because of the high morbidity associated with fistulas due to gallbladder disease, surgery is usually indicated unless there is some pressing contraindication. The absence, however, of cholangitis in patients with choledochoduodenal fistulas and its infrequency following choledochoduodenal anastomoses when no stricture is present suggest that mere visualization of the common duct with barium should not be an indication for surgery. If cholangitis develops it can be treated effectively with modern antibiotics; surgery can then be performed electively before significant liver damage can occur. Such a course seems preferable to prophylactic surgery to prevent cholangitis, which seldom develops as a complication of choledochoduodenal fistula.

The indications for surgery in a choledochoduodenal fistula without cholangitis should be the same as for peptic ulcer without the complication of a fistula, i.e., obstruction, bleeding, perforation or intractable pain. However, it is thought that the difficulty which would be encountered in the surgical management of a bleeding duodenal ulcer in a patient with a

choledochoduodenal fistula justifies a more liberal application of intractability as the indication for surgical management of duodenal ulcer in these cases. When surgery is indicated the treatment of choice is subtotal gastric resection with a Billroth II type of anastomosis if this is technically feasible without encroaching upon the common duct. If gastrectomy cannot be performed safely, vagotomy and gastroenterostomy can be substituted. However, if surgery is to prevent reflux, this procedure may or may not be successful depending in part upon the patency of the pylorus. This was demonstrated in our first case in which barium continued to reflux into the common duct following gastroenterostomy. We firmly believe that any surgical procedure designed to attack the fistula directly in an attempt to close it should be avoided. We would, therefore, not subscribe to the operation recommended by Tate and Shaw[18] which consisted of a subtotal gastric resection and partial duodenectomy with closure of the fistula and cholecystoduodenostomy. Rather than subject a patient to an operation of this magnitude for fear that the common duct may become strictured by healing of the fistula, it is preferable to reoperate upon the occasional patient in whom such a complication might arise.

SUMMARY

1. The incidence, etiology and prognosis of choledochoduodenal fistula is discussed.

2. Accurate diagnosis of choledochoduodenal and cholecystoduodenal fistulas is stressed because of their different prognosis and treatment.

3. Two cases of surgically treated choledochoduodenal fistula are presented.

4. Evidence is submitted to support the thesis that prophylaxis against cholangitis in such cases is not sufficient reason for operation.

5. The indications for surgery of choledochoduodenal fistula are discussed.

6. Gastric resection is recommended as the surgical procedure of choice; combined vagotomy and gastroenterostomy is the procedure of second choice.

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Unusual Complications from the Use of Intestinal Tubes and Drains

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EVERY physician knows well that the proper use of decompression tubes for the intestine or the stomach and drains of various types may be his most reliable aid in the constant and unrelentless battle with disease and disease processes. The slightest neglect or error in judgment can make these aids dangerous and lethal. As the field of medicine advances with new drugs and new operative procedures, the indications and contraindications for the use of decompression tubes and drains are in a constant state of flux.[1] It is only natural that conditions may vary markedly from patient to patient and from the previous experience of the physician involved.

CASE REPORTS

The following case histories demonstrate a wide variety of minor and major complications of a diversified nature arising from the use of intestinal tubes and drains.

CASE 1. J. S. (No. 268557), a forty-four year old vagrant male of Mexican extraction, was admitted to the King County Hospital on August 11, 1950, complaining of severe, knife-like, non-colicky, non-radiating, mid-abdominal pain of twenty-eight hours' duration. There was no associated nausea or vomiting or change in character of the stool. The patient denied any symptoms suggestive of gastrointestinal, gallbladder, liver or genitourinary disease. The positive findings on physical examination were as follows: The abdomen was rotund. No bowel sounds were audible. Generalized tenderness to palpation was noted throughout the abdomen, most marked on the right. There was generalized guarding, but no spasm. No palpable organs or masses were felt. Temperature was 37°C., blood pressure 140/80, pulse 80 and respirations 16. Laboratory examination revealed a hemoglobin of 12.2 gm., white blood count of 12,700, 76 per cent polymorphonuclear cells, a serum amylase showing 23 per cent lysis, and a urine amylase of 87. A roentgenogram of the chest suggested basal pneumonitis on the right. There was no free air beneath the diaphragm. A flat film of the abdomen revealed a gas pattern in the large and small intestines suggestive of paralytic ileus. The diagnosis of acute, severe pancreatitis was made, and the patient was treated with nasogastric suction by Levin tube, parenteral fluids and antispasmodics.

The patient's recovery was slow but apparent until the tenth hospital day when he experienced a severe, shaking chill followed by a rise in temperature to 39.5°C. He again complained of severe abdominal pain similar in nature to that on admission. The abdomen was moderately distended and bowel tones were again inaudible. A roentgenogram of the abdomen again suggested paralytic ileus. The left diaphragm was elevated and a small amount of fluid could be detected in the left thorax. Thoracentesis was performed and 200 cc. of clear yellow fluid were aspirated from the left hemothorax. A needle inserted into the left subdiaphragmatic space was productive of 300 cc. of yellow-green, odorless fluid which had an amylase activity of 18 lysis, and yielded Staphylococcus albus on culture. Penicillin therapy was instituted at this time.

On the eighteenth hospital day a large subdiaphragmatic abscess on the left was drained posteriorly, with resection of 8 cm. of the twelfth rib. A short section of rubber catheter was left in the wound to facilitate drainage. Culture of the purulent material revealed a growth of hemolytic Staph. aureus. The patient's general condition seemed improved following this procedure and he remained afebrile for the first six postoperative days. On the seventh day he started to spike daily temperatures up to 39.5°C. Needle aspiration of the anterior subcostal region on the left

was productive of 100 cc. of thick, yellow-green, purulent-appearing material. On the thirtieth hospital day the subdiaphragmatic abscess was drained. This was accomplished through a left anterior lateral subcostal incision with careful extraperitoneal dissection to the abscess pocket. Approximately 100 cc. of thick, yellow-green, purulent material were drained making communication with the previously drained cavity. Again a short section of rubber catheter was left, leading from the cavity to facilitate drainage. Hemolytic Staph. aureus was again obtained from culture from the abscess cavity most sensitive to aureomycin. Aureomycin therapy was instituted as the drug of choice.

Following this procedure the patient improved clinically; however, he continued to have a daily low grade temperature elevation. Drainage persisted from both drain sites. On the fifty-fourth hospital day the patient experienced a sudden onset of hemorrhage with gushing of blood from both drain sites. There was almost immediate shock with unobtainable pulse or blood pressure. As an emergency measure the patient was transfused with 1,000 cc. of Type O, Rh positive and 500 cc. of Type O, Rh negative unmatched blood. He was taken to the operating room immediately, and during the operative procedure received 2,000 cc. of matched Type O, Rh positive blood. At exploration it was found that the tip of the single rubber catheter, which was placed at the time of the second operation, had eroded into the splenic artery and the spleen substance at the hilus. Splenectomy was performed, and a Chaffin tube drain was placed in the splenic fossa. Immediately following surgery the patient received another 1,000 cc. of matched blood to bring the hemoglobin to 12 gm. and the hematocrit to 34 per cent.

The patient did surprisingly well following this catastrophe. The Chaffin tube drain was removed on the fifth postoperative day and the temperature gradually returned to normal. Convalescence was slow but improved steadily, and he was discharged from the hospital on the ninety-seventh hospital day.

The patient was followed subsequently in the Outpatient Department where he was treated for severe hypertension and renal insufficiency. The patient died on January 4, 1954. The findings at autopsy were chronic pancreatitis and small contracted kidneys compatible with chronic glomerulonephritis.

Summary. A forty-four year old male vagrant was admitted with severe, acute pancreatitis, resulting in a loculated subdiaphragmatic abscess. This was drained surgically and a double hard rubber catheter sump drain (Chaffin) was left in place to facilitate further drainage. Erosion of the splenic artery and hilus of the spleen by the tube resulted in acute severe hemorrhage necessitating immediate splenectomy as a life-saving procedure.

Case 11.* T. G. (No. 295467), a thirty-eight year old white woman, was admitted to the King County Hospital complaining of severe generalized abdominal pain of sudden onset five hours previously. A four-month history of epigastric preprandial pain relieved by food and alkali was obtained. The patient admitted taking large amounts of alcoholic beverages daily over a long period of time. Roentgenograms of the abdomen indicated the presence of free peritoneal air. The diagnosis of perforated peptic ulcer was made and she was taken to the operating room just six and three-quarter hours after the onset of pain.

At operation a 0.7 by 1.1 cm. perforation of the bowel was found just distal to the pylorus on the anterior superior surface of the duodenum. No other abnormality was noted. A 75 per cent subtotal gastric resection (Schoemaker modification of the Billroth 1) was performed. A Chaffin tube drain was placed in the subhepatic space adjacent to the anastomosis and was removed on about the fifth day. A Wangensteen tube, which had been placed prior to surgery, was allowed to remain in the residual stomach postoperatively. The midline upper abdominal incision was closed with interrupted No. 30 stainless steel wire sutures.

On the sixth hospital day the patient exhibited marked abdominal distention and the wound separated, causing drainage of 1,500 cc. of brown fluid. A small amount of methylene blue dye given by mouth promptly appeared in the abdominal wound. Immediate laparotomy was performed, revealing that the tip of the Wangensteen tube had penetrated the stomach wall for a distance of 6 cm. just 0.6 cm. proximal to the line of anastomosis. The tube was withdrawn and the defect closed with sutures of silk and a tab of omentum. The abdominal wound was then closed with buried interrupted No. 30 stainless steel wire alternated with No. 28 stainless steel wire

* This case has been previously reported.[2]

retention sutures. A serum protein determination obtained at this time was found to be only 3.88 gm./100 cc. The postoperative period was complicated by aspiration pneumonia, requiring bronchoscopy on the day following surgery and tracheotomy two days later, the ninth hospital day, to facilitate clearing of bronchial and tracheal secretions. On the tenth hospital day the wound again partially separated draining serosanguineous fluid. The patient had received supportive treatment in the form of antibiotics, whole blood, parenteral glucose, alcohol and amino acids. Serum protein determinations at this time were 4.97 gm./100 cc. A Wangensteen tube was inserted, and methylene blue instilled into the stomach appeared promptly in the wound. Drainage from the wound increased over the next three hospital days, and on the fourteenth hospital day she was taken to the operating room for the third time. The previously closed perforation had reopened and a small perforation of the duodenum was also found just distal to the anastomosis. These were closed with silk sutures and a Wangensteen tube was passed down into the jejunum for feeding purposes. This tube was withdrawn by the patient while recovering from anesthesia. It was soon apparent that the fistula between the stomach and the wound had re-established itself. On the twenty-first hospital day the total serum protein was 6.22 gm./100 cc. with an albumin of 1.6 gm. per cent and a globulin of 4.62 gm. per cent. This was the first time that an A/G ratio was determined.

On the twenty-third hospital day a Cantor tube was inserted into the gastric fistula, 2 mm. of mercury being placed in the balloon. No air was placed in the balloon. The Cantor tube was manipulated beyond the ligament of Treitz into the jejunum. High protein, high caloric tube-feeding preparation and aspirated bile were injected into the Cantor tube for feeding purposes. On the fiftieth hospital day the tube feedings were regurgitating back through the wound. A roentgenogram of the abdomen demonstrated gaseous distention of the Cantor tube balloon. Twenty cubic centimeters of 35 per cent diodrast® injected into the lumen of the bowel outlined the proximal dilated loop of jejunum. The diagnosis of intestinal obstruction was made, and the fourth exploratory laparotomy was performed. The Cantor tube was distended with gas and was lodged in the mid-jejunum. The bowel proximal to the balloon and for 6 cm. distal was dilated. At the distal point the jejunum was densely adherent to the viscera and the upper abdomen. The small bowel and colon distal to this point were collapsed. Four large interintestinal abscesses were evacuated. Adhesions were lysed and jejunostomy was made over the dilated balloon; the latter was removed from the tube after ligation of the neck of the balloon. The tube was removed from above. Side-to-side enteroenterostomy was performed to bypass the obstruction. A Witzel jejunostomy was made just distal to the enterostomy for feeding purposes. This procedure was well tolerated.

Tube feedings were instituted via the enterostomy catheter, and the patient continued to drain bile from a fistula emptying into the upper wound. The patient's general condition improved to a point where further corrective surgery could be undertaken with safety. One hundred fifty days following the last operation excision and repair of the duodenal fistula, closure of the duodenojejunostomy repair, closure of the gastric fistula and repair of the ventral hernia were performed. The postoperative period was uncomplicated; convalescence was gradual, but steadily improved. At present the patient is working part time in a convalescent hospital.

Summary. A thirty-eight year old white woman with a history of acute and chronic alcoholism was admitted with an acute, large perforated ulcer of the duodenum necessitating primary gastric resection. On the sixth hospital day her course was complicated by perforation of the residual stomach by the Wangensteen tube left in place at the time of surgery; this was closed surgically. On the fourteenth hospital day perforation of the duodenum and stomach necessitated further surgical intervention. A gastric fistula resulted and for the purpose of maintaining nutrition, a Cantor tube was inserted through the fistula tract into the stomach and jejunum for feeding purposes. On the fiftieth hospital day mechanical small bowel obstruction was evident in the mid-jejunum just distal to the Cantor tube tip. The balloon previously deflated was found to be distended with gas. The air portion of the tube was obstructed, preventing deflation and thus necessitating another operation for lysing of adhesions and removal of the Cantor tube balloon. Thus, this patient had three complica-

tions (two perforations and one obstructive incident) resulting from the drains.

CASE III. G. A. (No. 313106), a fifty-eight year old white man, was admitted to the King County Hospital on January 2, 1954, complaining of severe generalized pruritis of five days' duration and jaundice of increasing intensity over a two-week period. He had noted that his urine had become dark, and that his stools were pale and clay-colored. There was a history of increasing listlessness, anorexia and general malaise for a month prior to admission. There was a 10 pound weight loss. The patient denied any associated nausea, vomiting or pain.

Laboratory studies on admission were as follows: urine 4 plus, positive for bile; icteric index, 150; bilirubin (direct) 10.6, total, 13.3; stool bilirubin, negative; hematocrit, 45; white blood count, 9,800. An upper gastrointestinal barium study was reported as normal.

On the twelfth hospital day abdominal exploration was performed and a stony hard mass, 3½ by 4½ by 5 cm., was palpated on the head of the pancreas impinging upon the common duct and resulting in its complete obstruction. The common duct was distended to a diameter of 2.3 cm. The gallbladder was distended to two times its normal size and contained thick, dark, greenish black bile. No calculi were found. Palliative Roux en Y cholecystojejunostomy was performed as the procedure of choice. A T-tube was placed in the common duct and brought to the outside through a small stab wound in the right anterior abdomen. A Chaffin tube drain was placed into Morrison's pouch and brought through the abdominal wall through a separate stab wound just lateral to the T-tube. The abdomen was closed with interrupted wire sutures.

The patient tolerated this procedure well and the postoperative course was uneventful for the first thirteen days. On the fifteenth hospital day bile appeared in the Chaffin tube drain, suggesting a breakdown at the anastomosis. The T-tube in the common duct was draining adequately and bile was reaching the gastrointestinal tract, as evidenced by the stool. Bowel tones remained hypoactive and the abdomen gradually became moderately distended. On the twenty-fourth hospital day nasogastric suction produced 1,800 cc. of fluid in twenty-four hours. Fluid of the same character (1,300 cc.) was obtained from the T-tube over the same period of time. A cholangiogram demonstrated the obstruction of the distal portion of the common duct with retrograde flow of dye to the cystic duct, then to the gallbladder and into the bowel. Large dilated loops of small bowel suggestive of a mechanical obstruction were noted. A diagnosis of small bowel obstruction was made, and on the twenty-fifth hospital day laparotomy was performed.

Dilated loops of small bowel were found down to 2½ feet proximal to the ileocecal valve. Dense adhesions had formed in this area, holding the ileum to the right lateral anterior peritoneal wall at the point where the Chaffin tube drain had been placed during the previous surgery. The point of attachment was in continuity with the tract left by the Chaffin tube drain, which had eroded the bowel wall at this point, resulting in complete obstruction and occlusion of the lumen. In effect, the bowel had been pinched-off, necrosed and completely separated at this point without any evidence of widespread peritonitis.

Lysis of adhesions and enteroenterostomy were performed. The patient did well during the immediate postoperative period. Later, however, copious amounts of fluid arising from the peritoneal cavity drained from the operative site. This fluid was examined for amylase and over 600 units were reported. It was impossible to maintain adequate caloric or fluid intake through oral or parenteral routes. The patient's condition deteriorated progressively, and he died quietly on the sixty-fifth hospital day.

A culture taken from the abdominal wound prior to the patient's death revealed a pure culture of proteus sensitive to chloromycetin,® sterptomycin and penicillin. Following the last operative procedure the patient had been treated with aureomycin and penicillin. Pertinent findings at necropsy were adenocarcinoma of the head of the pancreas with evidence of acute and chronic pancreatitis, severe bilateral bronchial pneumonia, chronic obstructive biliary disease with biliary cirrhosis, and marked emaciation and dehydration.

Summary. A fifty-eight year old white man was admitted to the hospital with marked jaundice of short duration. A diagnosis of obstructive jaundice was made and verified at surgery when carcinoma of the head of the pancreas, completely occluding the common duct, was found. Palliative cholecystojejunostomy was performed. The Chaffin tube drain

was placed adjacent to the head of the pancreas. On the fifteenth hospital day a mechanical, small bowel obstruction necessitated a second laparotomy. It was discovered that the Chaffin tube drain placed at the previous operation had pinched-off, sealed and eroded through a segment of small bowel, resulting in complete small bowel obstruction without any evidence of generalized peritonitis.

CASE IV. W. J. C. (No. 299857), a fifty-two year old white man, was admitted to the King County Hospital on the evening of December 13, 1952, following emesis of a large amount of dark, "coffee ground-like" material. During the day the patient had passed several large semi-solid bowel movements which he described, at first, as being black and tar-like, gradually becoming a dark, reddish purple just prior to admission. For six weeks he had experienced severe mid-epigastric preprandial pain which could usually be controlled by food or alkali. There was a previous ulcer type history; an upper gastrointestinal series had been done elsewhere and was alleged to have demonstrated an ulcer of the duodenum. The patient was admitted to the Medical Service, but he continued to show evidence of upper gastrointestinal type bleeding in spite of all conservative medical measures.

The patient was transfused with whole blood in preparation for operation, and on the thirteenth hospital day subtotal gastric resection (Billroth 1 with a Finney-von Haberer-Schoemaker modification) was performed. The ulcer of the posterior lateral duodenum measured 2.2 by 2.4 cm. in diameter and was located just 2 cm. proximal to the ampulla of Vater, overlying the porta hepatis. Because of its position, the ulcer and its bed were left undisturbed. A Chaffin tube drain was placed through a stab wound into the abdominal cavity to drain the area of the ulcer bed and the area of the anastomosis.

The patient's immediate postoperative course was excellent. He was asymptomatic and afebrile. After the first three postoperative days very little material was obtained from the Chaffin tube drain. On the tenth postoperative day the drain was removed, followed by oozing from the drain site of an estimated 20 cc. of brownish colored fluid with an odor of feces.

It was assumed that the tip of the drain had eroded into the transverse colon and a colon-cutaneous fecal fistula had developed. Aureomycin and sulfasuxidine® therapy were instituted immediately. Fortunately, the fistula closed spontaneously and the patient was discharged home on the thirty-second hospital day, just twenty days postoperatively.

This patient has been followed subsequently in the Outpatient Department. He is asymptomatic and there is no evidence of recurrence of the ulcer or fistula.

Summary. A fifty-two year old white man was admitted to the hospital with acute, severe, upper gastrointestinal tract hemorrhage. A diagnosis of duodenal ulceration had been made previously, and the condition had been treated medically. Medical management of this acute episode was unsatisfactory, and after adequate whole blood transfusion subtotal gastric resection (Billroth 1) was performed and a Chaffin tube drain was placed near the ulcer bed. On the tenth postoperative day the drain was removed, followed by oozing of 20 cc. of brown fecal material. A colon-cutaneous fecal fistula had developed, and responded well to conservative management.

CASE V. C. N. (No. 219201), an eighty-four year old Negro man, was admitted to King County Hospital on February 26, 1953, complaining of severe, sharp, substernal pain aggravated by swallowing. He gave a history of gradually increased difficulties in swallowing over a two-month period. On admission only small sips of water could be taken. Physical examination confirmed the loss of 15 pounds during the two months previous to admission.

Esophagoscopy revealed a friable fungating lesion circumscribing the esophagus 37 cm. from the teeth. Biopsy revealed undifferentiated squamous cell carcinoma. It was believed that the esophagus was too friable to allow insertion of wire bougies, and a sidetracking procedure was recommended. Exploration on the fifteenth hospital day revealed no abdominal evidence of local or metastatic spread of the tumor. Approximately 60 cm. of small bowel, 20 cm. from the ligament of Treitz, was brought through the diaphragm into the anterior mediastinum, out through the skin in the neck and sutured to the skin near the lateral border of the left sternocleidomastoid muscle. A Roux en Y anastomosis was performed at the proximal portion in the abdomen. A Levin tube was left in place in the transplanted jejunal segment for twenty-four hours and then removed. The patient's postoperative course

was complicated by basilar pneumonitis and pneumohydrothorax on the left, which manifested itself first on the third postoperative day. This complication was successfully managed by thoracentesis, antibiotics and steam inhalations.

The patient was apparently assimilating increasing amounts of tube feedings through the cervical jejunostomy via Levin tube until the twenty-second postoperative day, when a gradual but steady decrease was noted for the following ten days at which time it was apparent that total obstruction existed and almost all of the feeding was returned. Barium studies revealed almost complete obstruction at the level of the diaphragm. A Cantor tube was passed in an attempt to penetrate the point of obstruction. On the forty-eighth hospital day it was apparent that obstruction was complete and had not responded to ten days of conservative management. Exploration revealed several inflammatory adhesive bands located below the diaphragm and above the Roux en Y anastomosis encompassing a redundant loop of jejunum. The obstruction appeared to have been precipitated from edema due to an erosive pressure change in the wall of the jejunum from the indwelling Levin tube. In this area there was a necrotizing loss of jejunal mucosa. No perforation was present. The tube was withdrawn and a Finney enteroenterostomy was performed in the abdomen following lysis of adhesions. The diaphragmatic opening was enlarged and the abdomen was closed.

The patient's course following this procedure was satisfactory until the fifty-sixth hospital day when it was evident that the transplanted jejunal loop was again obstructed. Barium placed in the segment demonstrated a partial obstruction at the tip of the catheter through which the material was injected. A Levin tube was inserted beyond the obstruction for feeding purposes. We were unable to maintain caloric or fluid intake at a satisfactory rate either through the jejunostomy or by the parenteral route. On the sixty-first hospital day a Stamm type of jejunostomy was performed. For the following four days the patient's condition deteriorated rapidly. He became comatose on the sixty-fourth hospital day and died quietly on the sixty-fifth hospital day, April 30, 1953.

At necropsy the peritoneal cavity contained 700 cc. of thick, turbid, green-brown fluid. The peritoneal surfaces were dull and reddish gray. There was a perforation of the superior anterior portion of the duodenum 2.5 cm. from the pylorus measuring 1.5 cm. in diameter, and erosion of the mucosa of the transplanted jejunal loop especially on the convex portions of the tortuous segments where the tube was in contact with the walls. This erosion had caused the lumen to be considerably narrowed in several places.

Summary. The patient, an eighty-five year old Negro man, underwent a first-stage Robertson procedure for carcinoma of the esophagus. A Levin tube was placed in the transplanted jejunal segment through the cervical jejunostomy opening for feeding purposes.

On the tenth postoperative day partial obstruction of the transplanted jejunal segment was evident. An attempt to ameliorate this with conservative management by the introduction of a Cantor tube beyond the obstruction at the level of the diaphragm was unsuccessful. After ten days of this treatment it was apparent that obstruction was complete and laparotomy was performed. Complete obstruction had resulted from edema due to an erosive necrotizing loss of jejunal mucosa from pressure on the bowel wall due to the indwelling tube. Perforation in this area was imminent.

The tube was withdrawn and a Finney enteroenterostomy was performed in the abdomen. The transplanted jejunal segment was again obstructed on the fifty-sixth hospital day. A Stamm type of abdominal jejunostomy was performed on the sixty-first hospital day to facilitate caloric intake and fluid balance. The patient died four days later from peritonitis following perforation of stress ulcer of the duodenum. The transplanted jejunal segment demonstrated considerable erosion of the convex limbs of its tortuous course where the tube had been in contact with the wall.

Case VI. S. G. (No. 262009), a sixty-seven year old, emaciated-appearing, white woman, was admitted to King County Hospital on February 14, 1950, complaining chiefly of frequency and burning of urination. A history of left nephrectomy eighteen months previously for pyonephrosis was obtained. The positive findings on physical examination were as follows: temperature, 38.5°C.; pulse, 90; blood pressure, 90/60; respirations, 18. Generalized abdominal distention was present without palpable organs or masses. There was moderate tenderness to palpation in the suprapubic area.

Laboratory findings on admission revealed the following data: hemoglobin, 10.2 gm.; white blood cells, 27,500 with 86 per cent polymorphonuclear cells; blood urea nitrogen, 100; urinalysis: alkaline reaction, 150 mg. of albumin per 100 cc.; sugar and acetone negative, packed with pus cells on microscopic examination. Stained smear revealed many gram-negative rods and gram-positive cocci. Penicillin and sulfadiazine therapy was instituted in treatment of the proposed urinary tract disease. Supportive treatment in the form of parenteral fluids was also given.

On the second hospital day the patient was found stuporous with a temperature elevation of 39°C. rectally. The abdomen was moderately distended, with a mass palpable in the right upper quadrant. The patient was incontinent of small amounts of semi-solid stool, which were dark brown and contained no mucus or blood. The white blood count had increased to 37,800. It was believed that a pathologic condition of the gallbladder could account for the palpable mass in the right upper quadrant and the elevated white blood count. On the third hospital day the abdomen was markedly distended with audible high-pitched peristaltic rushes suggestive of mechanical small bowel obstructions. A roentgenogram of the abdomen revealed a pattern of gas in the small bowel suggestive of partial mechanical obstruction. It was believed that the mass previously palpated in the right upper quadrant was a dilated loop of bowel.

A Wild tube was passed to the stomach and successfully manipulated beyond the ligament of Treitz to decompress the small bowel. The patient's general condition seemed improved. The blood urea nitrogen level dropped to 35. The white blood count remained elevated at 21,000. The patient refused to take nourishment orally, and fluid and caloric requirements had to be administered by parenteral route. At no time during the hospital course was the patient in satisfactory condition for operation. Any attempt to discontinue the intestinal decompression by clamping the suction tube resulted in abdominal distention. On the thirteenth hospital day it was noted that the urinary output had decreased from the usual 1,500 cc. to 100 cc. over a twenty-four-hour period. Parenteral fluid in this patient was readjusted accordingly. Serum determination of sodium was 128 mg./L. and chlorides, 102 mEq./L. The potassium was 5 mg./L. and the blood urea nitrogen was 91.5.

On the fifteenth hospital day the abdomen was again markedly distended with a fluid wave present. A paracentesis was performed removing 4,000 cc. of pale, yellowish green fluid. Cell block fluid obtained for malignant cells was negative. There was no noticeable increase in the fluid recovered from the intestinal intubation tube until the eighteenth hospital day. The urinary output remained at a level below 100 cc. per twenty-four-hour period. Laboratory studies at this time were as follows: hemoglobin, 9.2 gm.; white blood cells, 48,500; hematocrit, 32; total serum protein, 3.1 gm. per 100 cc.; blood urea nitrogen, 41.5; CO_2, 34 volumes per cent.

A roentgenogram of the abdomen revealed the tip of the Wild tube to be located approximately at the center of the bony pelvis with a moderate amount of gas in the terminal ileum and ascending colon. One ounce of a thin barium mixture inserted through the tube passed into the lumen of the bowel through the tube openings proximal to the tip. A moderate length of bowel proximal to the tip was filled with a thin barium mixture. A radiograph made at the end of fifteen minutes showed no significant changes from the preliminary injection film. At the end of one hour some barium had passed into the lower portion of the small bowel at the site of apparent obstruction in the lower central pelvis. The most interesting radiograph was made at the end of three hours, at which time the barium seemed to be located in both the lower portion of the small bowel and the urinary bladder. At the end of eighteen hours the barium had apparently passed through the urethra. Throughout the examination there was barium between the point of apparent fistula formation, and between the bladder and the lower small bowel and cecum. The following day a cystogram was obtained by injecting an opaque medium into the urinary bladder which outlined the bladder and extended upward into the small bowel through an apparent ileovesical fistula. The mercury bag on the tip of the Wild tube appeared to remain in constant relationship with the bladder, and was felt to be within the bladder itself. A rubber catheter was left in the bladder which drained a small amount of blood and intestinal content. The patient remained comatose for two days prior to a quiet death

on the twenty-fourth hospital day. The positive findings at necropsy were those of epidermoid carcinoma of the urinary bladder, chronic pyonephritis, ileovesical fistula, generalized peritonitis and bilateral bronchopneumonia.

Summary. A sixty-seven year old white woman was admitted to the hospital with signs and symptoms of acute cystitis. There was a previous history of left nephrectomy eighteen months prior to this admission for pyonephrosis. Shortly after admission clinical findings developed compatible with mechanical small bowel obstruction. Intestinal intubation with a Wild tube satisfactorily decompressed the distended bowel. The patient's general condition would not permit surgical intervention. Fluid and electrolyte balance were maintained by the parenteral route. On the tenth day of this regimen the patient suddenly became oliguric, and on the twelfth day abdominal ascites was noted for which paracentesis was performed. Roentgenologic examination disclosed the tip of the Wild tube resting in the urinary bladder. The diagnosis of carcinoma of the urinary bladder with extension to the small bowel was confirmed at necropsy.

COMMENTS

The distinct advantage of reviewing these past case histories may easily invoke criticism. Unfortunately, such criticism would be little more than worthless unless some definite rules or conclusions could be drawn to aid physicians in the future.

In the report of J. S. (Case I), a patient with poor nutritional status due to prolonged convalescence from severe pancreatitis, the multilocular abscess cavities were probably inadequately drained, resulting in the necessity of keeping the cut rubber catheter drains in place for a prolonged period of time, which caused pressure erosion into the splenic artery and splenic substance.

Although the patient in Case II was only thirty-eight years old, she could certainly be considered nutritionally debilitated as the result of poor diet and prolonged alcoholic intake. This undoubtedly was responsible for the poor tissue turgor and tissue response following surgery, which allowed the tip of the intubation tube to penetrate the stomach wall. This was most probably the cause of the second perforation of the duodenum and stomach, which necessitated the third operation. The peritoneal infections, multiple mesenteric abscesses and fistula formations involved in her prolonged convalescence are evidence of the inability of the tissues to respond in a normal manner.

The final catastrophe of intestinal obstruction resulted from gaseous distention of the Cantor tube balloon. This interesting phenomenon is cited in Cantor's monograph,[3] which calls attention to the fact that the behavior of gases in rubber is similar to that of gases in organic liquids of high molecular weight. A gas dissolves into the rubber on one side of the membrane and evaporates from the other surface. There is a permeation of the membrane by the gas passing from an atmosphere of increased pressure into one of decreased pressure for that specific gas, until equal pressures of the gas are obtained on both sides of the membrane.

In Case III, if it were necessary to leave the Chaffin tube drain in place for twelve days postoperatively, no way of averting such a catastrophe is evident, provided adequate care was used in placing the drain initially. The main question arises as to whether it was necessary to leave the drain in place so long.

In Case IV the Chaffin tube drain was undoubtedly left in place longer than necessary. There was very little drainage after the fourth postoperative day, and yet the drain was not removed until the tenth postoperative day when the colon-cutaneous fistula had formed.

In Case V, although it is obvious that the Cantor tube cannot be incriminated in the original obstruction (due to the inflammatory adhesions found at exploration), a far more serious complication was initiated at that time, as noted by the discovery of the area of mucosal erosion caused by the pressure of the intubation tube.

The patient in Case VI had to be treated when in extremely poor nutritional status and with poor tissue response as the result of chronic urinary tract infection and carcinoma of the urinary bladder, the latter diagnosed only at necropsy. There is no question but that the carcinoma was an initiating factor responsible for the ileovesical fistula, and that the tip of the Wild tube penetrated the bowel wall into the bladder in this weakened area.

Each of these patients was in a poor nutritional state. They were debilitated, with an

inadequate physiologic response to noxious stimuli as a result of the underlying disease or chronic infection. This type of individual is not only a poor surgical risk but also a risk with any procedure. These patients are the ones who most often require the use of drains and intestinal intubation tubes in their therapy, medical or surgical.

Physicians should recognize that there is always a calculated risk with every diagnostic or therapeutic procedure used. If such a procedure becomes routine one tends to forget about these possibilities, ignoring or taking for granted all the routine precautions that were first abided by when these procedures were new.

The following time-tested rules may help avert catastrophe: (1) Careful selection of the type of drain or tube to be used. Is it adequate for the purpose? (2) Use of utmost care in its placement. Will it injure any vital adjacent structure? (3) Frequent check-ups to insure that it is in proper position and functioning properly. (4) Prompt removal when its purpose has been fulfilled.

SUMMARY

1. The possibility of complications resulting from the use of intestinal tubes and drains is discussed.

2. Six case histories are presented which illustrate a variety of unusual complications resulting from the use of intestinal tubes or abdominal drains.

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Recurrent Anterior Dislocation of the Shoulder

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Although recurrent dislocation of the shoulder is one of the oldest recognized orthopedic entities and has been the subject of voluminous writings in the literature, indicating continual interest, practically every phase of the lesion remains controversial today. It might be said that there is agreement on only two aspects of the lesion, namely, the clinical manifestations and the clear-cut indication for operative treatment.

It is not the purpose here to discuss in detail the several theories of etiology and pathogenesis or to review the numerous operative procedures and point out their respective merits. Of greater interest is some conception of the current trend in opinion on the different aspects of the lesion after many years of investigation. One objective of this article is to examine this trend as it appears from a survey of contributions to world literature during approximately the past seven years.

A second objective is to present a report on thirteen patients who were treated by the Bankart operation. The series is small in number but it serves to augment statistical data on long-term experience with this method. If the therapeutic problem is to be resolved, surgeons must recount their experiences, for only by so doing will large compilations of cases eventually be made which will permit evaluation of a particular method of treatment.

Etiology and Pathogenesis

A well established fact on the origin of recurrent dislocation is that in the great majority of cases it starts with traumatic dislocation, usually due to a fall. The lesion is also not uncommon in persons with epilepsy. Familial involvement or bilateral dislocation is occasionally encountered, and it is generally assumed that in such cases there is a constitutional predisposition to recurrence in the form of a weak muscular or ligamentous structure or an anatomic variation.

The explanation for recurrence after traumatic dislocation in some cases, and not in others, is still being sought. There is little evidence in support of the theory that inadequate treatment of the primary injury is the factor responsible for recurrence. It is true that too short a period of immobilization to permit healing of the original damage has been a characteristic feature of the history of many patients; however, there have also been many cases of recurrence when the primary dislocation was adequately treated.

Bankart's[3] theory that the mode of production of the initial dislocation in recurrent lesions differs from that in single traumatic dislocations is no longer generally accepted. Investigation has proved that the mechanism of injury of the recurrent and non-recurrent types of anterior dislocation of the shoulder cannot be distinguished.

Most surgeons have long agreed that some residual defect in the joint structure after traumatic dislocation predisposes to recurrence. Opinion differs as to the seat of the primary damage and no constant lesion has been demonstrated. Two elements predominate in the pathologic picture: (1) damage to the anterior glenoid rim; and (2) a defect in the posterolateral aspect of the humeral head. It was Bankart's[3] theory that the glenoid labrum and capsule always become detached at the anterior margin when the humeral head is levered forward. There has been ample evidence in the past to support this concept of pathogenesis, and data published within recent years have continued to substantiate it.[2, 10, 17, 28, 49, 52] On the other hand, few contend, as Bankart, that detachment of the glenoid labrum is the essential lesion, and there have been many cases in which no destruction of the anterior glenoid rim was observed at operation.

A defect in the posterolateral aspect of the humeral head has long been recognized as a pathologic lesion in recurrent dislocation, but

within recent years more attention has been focused on the significance of the lesion.[2,25,35,40,53] Undoubtedly more effort is being made to determine the presence of this defect, which is seldom demonstrated in routine roentgenographic projections and not uncovered in the usual operative exposures. The defect of the humeral head is attributed by some observers to a congenital anomaly; others maintain that the defect represents a compression fracture resulting from impingement of the posterolateral area of the humeral head against the glenoid margin. One school believes that the damage occurs at the time of the initial dislocation, and that once the groove has developed dislocation may easily recur upon abduction and external rotation of the arm. Still another school contends that the defect is a late phenomenon, occurring as the result of repeated dislocations. A defect in the humeral head is frequently associated with damage of the glenoid rim, and in such cases, it is generally agreed, the tendency toward recurrence is increased.

Two other concepts of pathogenesis are recognized: One is concerned with the disruption of the anterior capsule and the other with imbalance of the shoulder musculature. It is my opinion that stripping of the capsule, which tends to occur in any joint dislocation, is an important pathologic element. Rents in the capsule have been described but there is some question as to whether actual tears can occur. Because of the difficulty of estimating the normal laxity of the capsule of the shoulder joint, less interest has been taken in this postulate.

The concept of neuromuscular imbalance has been staunchly supported by DePalma.[10] The external rotator muscles and their antagonists are considered to be the muscles involved, the power of the former being increased as the result of direct injury or stretching of the latter group, in particular the subscapularis muscle. Inasmuch as dislocation of the shoulder tends to recur when the arm is rotated externally, such muscle imbalance would be a factor in causing recurrence.

Any study of the various concepts of pathogenesis must lead to the conclusion that there is as yet no complete solution. Detachment of the glenoid labrum appears to be the predominating lesion; but until further research and studies documented by data on operative findings are forthcoming, pathologic changes postulated in the glenoid labrum, capsule and humeral head, as well as in the shoulder musculature, must be taken into consideration.

CLINICAL PICTURE

A patient usually considers an injury to be the cause of the recurrent dislocation. The typical history is that of a young adult, usually a healthy and muscular man, who sustained a traumatic dislocation of the shoulder while participating in some sport. The dislocation was reduced and the shoulder functioned normally for a few months when a second dislocation occurred, in some cases under circumstances similar to those of the initial episode but usually in consequence of some insignificant trauma. Thereafter recurrence took place with varying frequency. In long-standing cases slipping may have occurred while the patient turned in sleep, or the shoulder may have repeatedly dislocated on any ordinary movement that involved abduction and external rotation of the arm, such as putting on a coat or combing the hair. The writer has observed in his experience that whenever two recurrences have been sustained there are subsequent episodes.

Little actual discomfort is experienced when the shoulder dislocates, and the patient himself may be able to force the humeral head back into place. Nevertheless, the lesion represents real disability. Rest may be disturbed. The patient may hesitate to carry out some of the commonplace functions of daily living. Even when the humeral head tends to subluxate, rather than to dislocate completely, the patient is harassed and obsessed by the fear of total displacement. A young athlete is particularly handicapped by the lesion, and a man earning a livelihood suffers a considerable loss of working capacity.

By the time the patient is first seen there is little on which the surgeon can base the diagnosis except the history of acute traumatic dislocation followed by recurrences. Examination of the shoulder produces little in the way of objective signs. Routine roentgenographic examination sometimes demonstrates a groove in the humeral head, provided that it is well defined. Special projections must be made to visualize smaller defects as well as pathologic changes in the anterior glenoid margin.

TREATMENT

Innumerable operations have been described for the repair of recurrent dislocation, and new

procedures and modifications of older methods continue to be proposed. However, reports appearing within the past seven years indicate that operative treatment is being confined for the most part to relatively few procedures.

Five different operative methods are in popular use. French surgeons have continued to favor the coracoid buttress operation introduced by Oudard[39] which aims at creating a bone block to prevent exit of the humeral head and shortening of the subscapularis tendon. Oudard's early technic consisted of elongating the coracoid process by sectioning the apophysis and interposing a bone graft; later he proposed the technic of prolonging the process by sectioning it diagonally and sliding one fragment downward. There have been several modifications of the Oudard method, the best known of which is the simpler Lenormant-Wilmoth[26] technic in which a free bone graft is wedged between the tip of the coracoid process and the coracobicipital tendon and the short head of the biceps.

Among the end result studies of this type of buttress operation published since 1944 was Thomasen's[48] compilation of sixty-nine cases, including nine personal cases. This series showed a recurrence of 10 per cent. Foucher's[16] investigation of the end results in a series of eleven operations performed according to the Lenormant-Wilmoth technic by different surgeons was most discouraging; dislocation recurred in four cases and one patient had a weak shoulder. Sicard[45] reported having used a modification of Oudard's operation in twenty-nine cases with gratifying results. In the past year, Bianchi-Maiocchi[5] reviewed six cases which had been treated by this method from five to six years previously. There were five good results; one dislocation recurred due to absorption of the graft.

In Germany, and particularly in the Scandinavian countries, surgeons remain faithful to the Eden-Hybbinette[12,22] bone block type of operation. This procedure consists of reconstructing the damaged glenoid margin by implanting a bone graft into its anteroinferior surface at the site of dislocation. Criticism of this method has been the difficulties of technic, the danger of absorption or non-union of the bone graft and postoperative restriction of motion as well as pain.

More statistical data have been reported on end results of this procedure than of any other method. A series of 773 cases treated with the Eden-Hybbinette method or by a modification has been compiled from literature appearing in the ten-year period from 1944 to 1954.[1,13–15,20,21,23,25,40,43,48,51] Dislocation recurred in fifty-five cases (7 per cent).

In Anglo-Saxon countries the operations of Magnuson and Stack,[30] Putti and Platt,[6] and Bankart,[3] or modifications of these procedures, are considered the most effective methods. Each of the procedures has been supported by successful end result studies. All three operations have as the common objective control of the external rotational movement of the shoulder. This is accomplished in the Magnuson technic by transferring the insertion of the subscapularis muscle from the lesser to the greater tuberosity, shortening both the muscle and the anterior capsule. The Putti-Platt technic combines imbrication of the anterior portion of the capsule with shortening of the subscapularis muscle. A postoperative limitation of the external rotational movement has not infrequently been mentioned as a disadvantage of both these methods.

The Bankart operation, based on the recognition of the detachment of the glenoid labrum and anterior capsule as the underlying pathologic lesion, is directed to the reattachment of the fibrocapsular segment to the glenoid rim. Both the Magnuson-Stack and Putti-Platt operations are considered to be somewhat easier than the Bankart method in that the technic is less complicated and inspection of the joint is not required. However, it is the Bankart method that has stood out prominently from all other procedures in recent years and that has been widely used.

There are as yet few statistics on end results of the Magnuson-Stack and Putti-Platt operative measures. In a series of eighty-two patients treated with the Magnuson method (thirty-one by Giannestras,[19] eight by Jens,[24] thirteen by Palumbo and Quirin,[41] and thirty by Vare[50]) dislocation recurred in 2.4 per cent. DePalma[10] reported two recurrences (8.7 per cent) in a group of twenty-three patients treated with a modification of the Magnuson-Stack technic. More recently, Gartland and Dowling[18] reported the end results in a series of nineteen cases in which a modification of the Magnuson technic was used. The recurrence rate was 10.5 per cent. Robertson[42] added another series of fourteen cases treated with the Magnuson technic in which no recurrences had been reported.

In a series of seventy-five cases treated with the Putti-Platt operation (two by Castro,[8] twenty by Brav and Gulledge,[7] sixteen by Severin[44] and thirty-seven by Adams[2]) there were only two recurrences (2.6 per cent). Platt claimed never to have had a recurrence, and Putti estimated the cures at 84 per cent.[38]

Less meager are reports of end results of the Bankart operation, the majority of which were published prior to 1949. Statistics extracted from the literature from 1938 to 1954 include 278 end results.[4,9,11,23,32–34,36,49] There were only two recurrences (less than 1 per cent) in the series. Many general statements are also to be found in the literature, particularly in recent reports, indicating that the results of the Bankart operation are uniformly satisfactory. Bankart himself reported having used the operation for thirty years without a single recurrence.[46]

A comparative evaluation of the five methods in popular use should not be attempted from the figures quoted. It would appear that the Oudard technic which, in the given compilation of eighty-six cases had a recurrence rate of 14 per cent, is the least promising. French surgeons themselves are no longer enthusiastic about it.[47] The results of the Eden-Hybbinette bone block method are much more favorable, recurrence amounting to only 7 per cent in 773 cases. From the standpoint of recurrence, the Magnuson-Stack operation and the Putti-Platt and Bankart technics appear to be giving still more encouraging results, with the recurrence rate lowest after the Bankart procedure. The functional results of the Bankart operation have also been more favorable; the postoperative complications of pain and restriction of external rotational movement, which are often reported with the use of other methods, are seldom encountered.

OPERATIVE TECHNIC

The Bankart operation has generally been open to the criticism of being technically difficult. In the operation as described by Bankart the fibrocartilage is sutured to the scapular rim; this method may prove to be a trying process in some cases. The technic may be considerably simplified by the use of metal staples in the labrum-capsular repair, a method of fixation which several surgeons have used successfully.[4,9,11,27,31,34,37] No unfortunate reaction to the staples has been reported although many years have passed since the operation in some cases. I have been using staple fixation with success for several years.

The operation is carried out as follows: The patient rests on his back with a sandbag between the shoulder blades. The involved arm lies close to the body with the elbow resting on a sandbag.

An anterior incision is made beginning just above the coracoid process and extending distally for approximately 5 inches along the interval between the deltoid and pectoralis major. After blunt dissection of the muscles, with care taken to avoid the cephalic vein, the pectoralis major is retracted to the inner side and the deltoid along with the cephalic vein to the outer side.

The coracoid process is divided superiorly with an osteotome just above its muscle attachments, and the tip of the apophysis together with the muscle origins is reflected downward. The subscapularis is now in view.

A forceps is placed beneath the subscapularis muscle. The arm is rotated outward to make the transverse fibers of the subscapularis tendon distinct. After a stay suture has been placed in the tendon close to its insertion on the lesser tuberosity, the tendon is sectioned vertically to the outer side of the suture. The muscle is then carefully dissected from the capsule and retracted inward.

The anterior aspect of the capsule, which is now exposed, is incised parallel to the glenoid rim and approximately ½ inch away from it, fashioning medial and lateral flaps. The proximal portion of the capsule is reflected to the midline. (Fig. 1.)

With the humeral head maintained in external rotation and forced backward, the damage to the glenoid rim is examined. A freshly bleeding surface is then created on the anterior glenoid rim by removing a shaving of bone with a chisel. (Fig. 2.)

Capsular repair is effected with the arm held in internal rotation. The edge of the lateral capsular flap is first approximated to the raw surface on the glenoid rim and anchored in place by means of one or two staples. (Fig. 3.) The medial capsular flap is then plicated tightly over the lateral capsule in double-breasted fashion and sutured with chromic catgut sutures. (Fig. 4.) Before the sutures are tied, the range of motion in external rotation should be tested in order to make certain that the

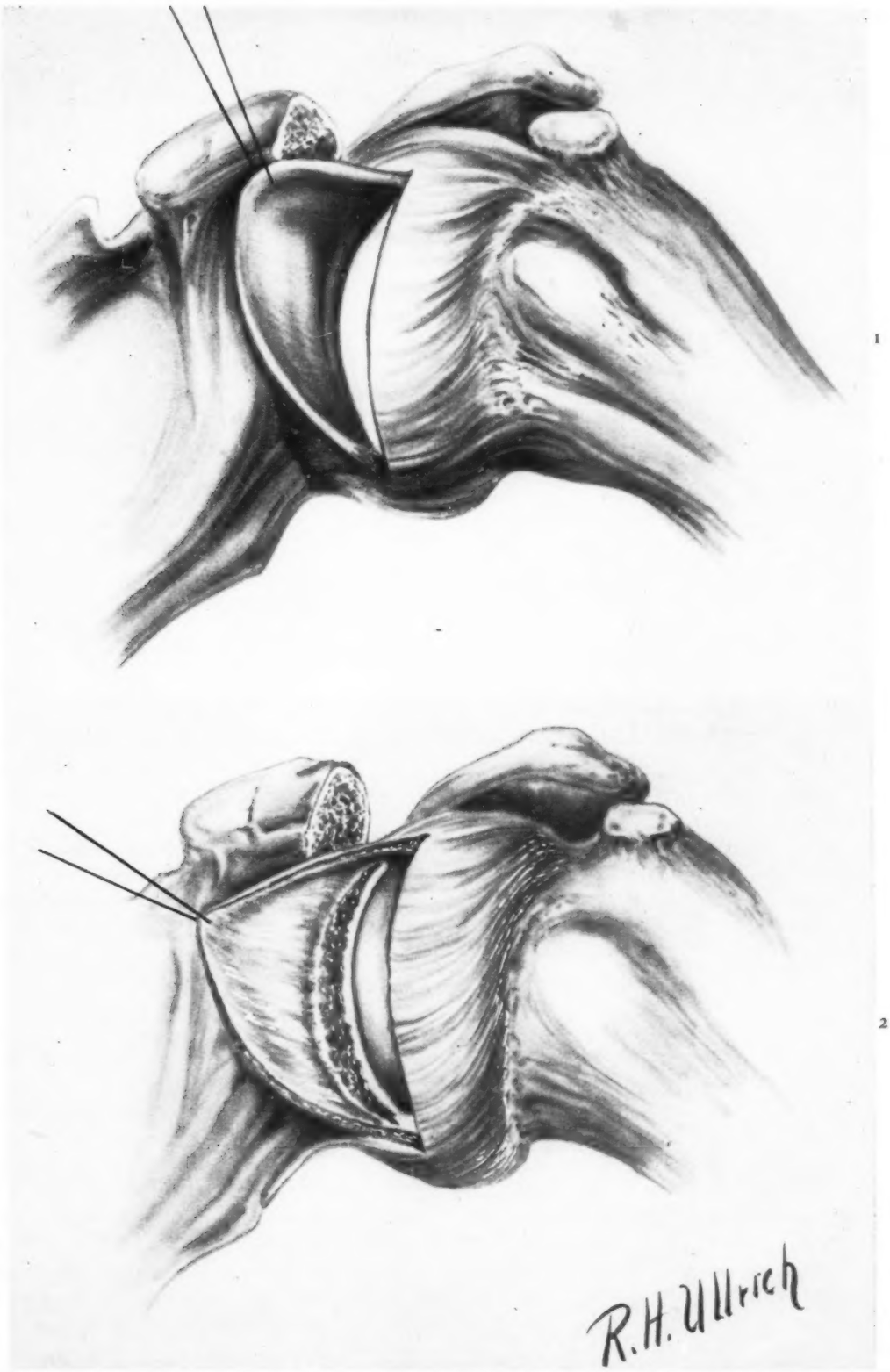

FIG. 1. Incision of the anterior capsule and reflection of the medial flap, exposing the glenoid margin.

FIG. 2. The anterior glenoid margin has been freshened by removing a shaving of bone.

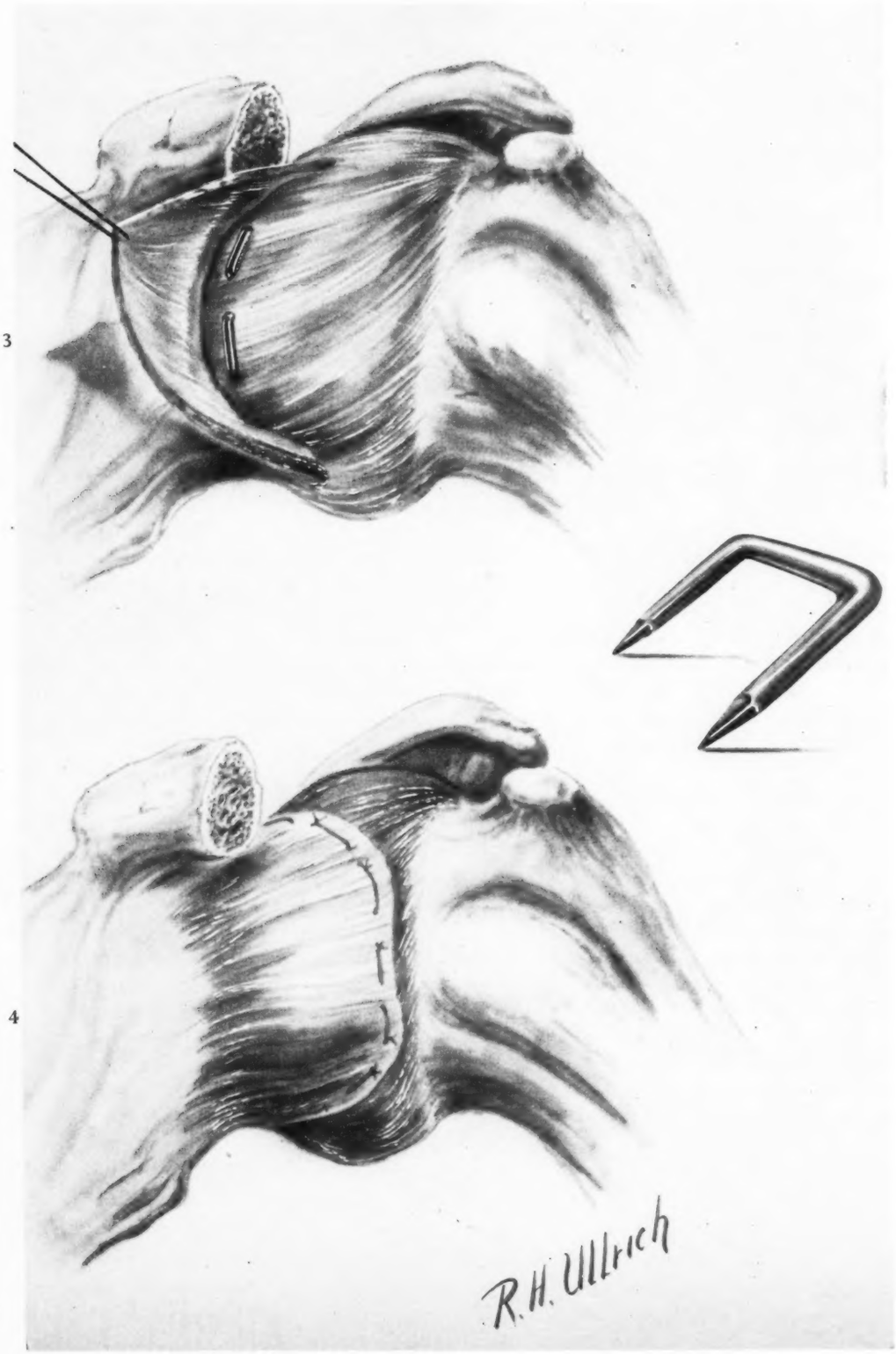

FIG. 3. Anchorage of the lateral capsular flap on the raw glenoid surface by means of staples.
FIG. 4. Plication of the medial capsular flap over the lateral capsule and suture.

movement is slightly limited. If the capsule is unusually relaxed, more overlapping of the capsular flaps will be necessary to restrict the external rotational movement.

The divided subscapularis muscle is sutured. The detached portion of the coracoid process is fixed to its base by means of a screw. The deltoid and pectoralis major muscles are allowed to fall back in place. The skin is closed with interrupted silk sutures.

Postoperative Care. The arm is immobilized with the elbow at the side and the forearm across the chest for a period of six weeks. A circular swathe and a neck-wrist sling are used for fixation purposes. Active use of the arm is authorized after six weeks, but no overhead reaching is permitted until three months have elapsed from the time of the operation. Physiotherapy and exercises, particularly swimming with the exception of the crawl stroke, aid in regaining the full range of motion.

Operative Treatment and Humeral Head Defects. In the operative procedure that has been described no attempt is made to determine a defect in the posterolateral surface of the humeral head. It is my opinion that even though such a defect is present, the humeral head cannot escape from the glenoid cavity once the fibrocapsular repair has been made.

COMMENTS

My experience in treating recurrent dislocation of the shoulder over a period of many years has followed the usual pattern. Capsulorrhaphy or reefing of the capsule was carried out in the early cases. An analysis of the results in a series of fourteen patients, several of whom were traced after a period of many years, showed that although some good results were obtained recurrence was indisputable in a high percentage of the cases.[29] Loop suspension operations using fascia lata were performed in eight cases but again the results were not encouraging.

The Nicola[35] method, which was popular from the mid-thirties to the mid-forties, was next used. Twenty-four patients were operated upon using this method. Although every effort was recently made to follow up these patients, the end results could be ascertained in only twelve cases. Seven of the patients had experienced no recurrence and the shoulder had excellent function. All were able to perform heavy work. The other five patients had suffered recurrences on several occasions. Thus the percentage of failure in twelve cases was over 40 per cent.

The first operation of the Bankart type was performed in 1946, and up to the present time thirteen patients have been treated with this method. Eleven of the thirteen patients were men. The youngest was seventeen years of age and the oldest, forty-three; the average age was twenty-four.

External violence had been the cause of the initial dislocation in ten cases, five of the patients having sustained the injury while participating in a sport such as football, skiing or basketball. Two of the group were patients with epilepsy who had experienced dislocations during seizures. In one case there was no history of a specific injury, the patient having experienced the initial dislocation when reaching upward for an object.

All patients had had at least three dislocations of the shoulder. Two patients complained of almost constant recurrence on certain unguarded movements. Several patients had been more or less incapacitated by the lesion for a period varying from four to nine years. Previous surgical treatment according to the Nicola technic had been carried out without benefit in three of the cases.

Results. Twelve of the thirteen patients were personally re-examined after a postoperative period varying from two to nine years. None of the patients had suffered a recurrence. The remaining patient in the series, a young man with epilepsy, had died two years after the operation; his mother reported that he had complained of a snapping sensation in the shoulder simulating a partial slipping of the humeral head.

All patients claimed that the functional recuperation of the joint was complete; however, upon examination mild restriction of external rotation, and in some cases of abduction as well, were observed. Some restriction of these movements is in fact a safeguard against recurrence. Apparently the patients were in no way inconvenienced by the slight loss in the range of motion, which was well compensated by scapular movement.

All twelve patients were using the shoulder without restraint in work which in every case required physical exertion. Four patients performed hard work in factories, one drove a truck, another stacked the shelves in a grocery

store, two cared for their homes, and four patients had recently been on duty with the Armed Forces. One of this last group has requested operation upon his other shoulder which dislocated three times while he was in the army. Several patients, being active young men, indulged freely in sports.

Pathologic Changes. Careful observation was made upon opening the capsule and exploring the glenoid cavity. In every case the glenoid labrum was found detached from the glenoid rim and the capsule separated in the anterior aspect of the joint. The pathologic changes represented the typical basic lesion described by Bankart. The separated portion of the glenoid labrum was as a rule well defined and not frayed or atrophied. No attempt was made to ascertain the presence of a defect in the humeral head.

SUMMARY AND CONCLUSIONS

The current trend in opinion regarding the various phases of the controversial lesion of recurrent anterior dislocation of the shoulder is examined, using as a basis of study the reports appearing in the literature during the past seven years.

It is pointed out that the underlying pathologic condition is not finally established. The long-recognized theories of a defect in the anterior glenoid margin and a depression in the posterolateral surface of the humeral head must still be given consideration. Recently an explanation for recurrence of dislocation has been sought in an alteration of the tonus of the shoulder musculature. Without question, Bankart's concept of detachment of the glenoid labrum and anterior capsule is the most generally accepted theory.

Attention is called to the fact that treatment has been largely confined during the past few years to five different methods: the Oudard technic, the Eden-Hybbinette technic, the Magnuson-Stack method, the Putti-Platt method and Bankart's procedure. Each method is briefly described and compilations are presented of statistical data on end results taken from the world literature. Studies of long-term results are still too few to permit evaluation of the different methods. There is ample reason, however, to have confidence in the Bankart procedure, for results from the standpoint of both recurrence and functional recuperation continue to be promising.

A description is given of the Bankart technic in which the step of suturing the glenoid labrum in place, long recognized as a difficult process, is simplified by the use of metal staples.

Personal experience in treating recurrent dislocation over a period of many years is recounted. A report is given on thirteen cases in which the Bankart operation, simplified by using staples for fixation purposes, was used. Twelve of the thirteen patients obtained excellent results; no recurrence has been experienced and the shoulders have good function.

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Surgical Consideration of Parotid Tumors

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THE purpose of this paper is to outline the surgical approach for removal of a parotid tumor. The procedure can be simple and uncomplicated, or it can be tedious with many fears and complications. The operation can be performed in less than an hour; sometimes it may require three to five hours of tedious dissection. The tumor may be outside the parotid gland, in the lymph nodes, exterior to the parotid capsule, deep within the superficial lobe, or closely associated with the facial nerve or its important branches. The tumor may be well defined or it may be infiltrative. The location of the tumor may determine the ease of its removal.

A swelling in front of or below the ear must be diagnosed as a parotid tumor until proved otherwise. The patient with a tumor in this location should be urged to have it removed as soon as possible. True diagnosis is made only on pathologic examination of the tissue. Some tumors, such as mixed tumors, are best treated by surgical removal while others, such as hemangiomas, are treated with greater success by radiation therapy. Still others are best treated by partial or total parotidectomy or lobectomy.

The following outline presents a working classification of parotid tumors:

I. Cyst
   A. Simple cyst due to atresia or obstruction of a duct and congenital defects
   B. Cystic changes of the parotid glands secondary to parotid parotitis with calcinosis

II. Adenoma
   Very rare, usually encapsulated, grows slowly; in microscopic appearance it mimics the parent gland

III. Adenocarcinoma
   A. Simple
   B. Papillary
   Carcinoma may be well differentiated or infiltrated anaplastic; mitosis may be little or great and staining characteristics of the cells are variable

IV. Mixed tumors
   These tumors vary considerably and are composed of three principal components:
   A. Epithelial cells in cords or ducts
   B. Connective tissue
   C. Cartilage
   Such tumors grow slowly and usually are well encapsulated. They have a tendency to recur, and may occur at all ages but principally after middle age. They may be found within the gland, outside the capsule or in the cheek. Their geneology is not known, but it is thought to be from cell rests (embryonal). Some pathologists consider mixed tumors as malignant lesions and grade them accordingly, depending upon whether they are encapsulated, if the capsules are true capsules or infiltrated by epithelial elements, amount of mitosis present and staining characteristics, and arrangement of the epithelial element present. They may be graded as: (1) benign mixed tumors—well encapsulated, lacking mitosis, non-infiltrative; (2) grade I carcinoma: when capsule is infiltrated with epithelial elements and some mitosis is observed microscopically; (3) grade II: same except more pronounced than grade I; (4) grade III: mitosis and invasion of capsule and, pathologically, definitely carcinoma.

V. Entodermal cyst or adenolymphoma, often called papillary cystadenoma lymphomatosum

VI. Tumors of non-glandular origin (blood vessels, nerve, lymphoid tissue and fibrous tissue)

The following is an analysis of a review of seventy cases of parotid tumors from Spokane hospitals from 1950 through 1954. The youngest patient was four months old, the oldest eighty-nine, with an average age of forty-six.

In the young individual the hemangioma and lymphangioma are the most common tumors. Acute infection, abscesses or parotitis are next in frequency. The youngest person having a mixed tumor was fourteen years of age. The majority of patients having mixed tumors are over fifty years of age. The malignant lesions are predominantly found in patients after the age of fifty. The incidence of female predominance (72 per cent) to male (28 per cent) in our series is compatible with other series. Why the female is more susceptible to parotid tumors is in direct relationship to general endocrine involvement; the disease of the thyroid, breast, ovary, pituitary and adrenals in the female surpasses similar involvement in the male thyroid, pituitary, adrenals, testes and prostate. There was 60 per cent involvement of the left parotid gland and 40 per cent of the right parotid gland. Anatomically, there is no actual reason why one should be involved more than the other.

Tumors of the parotid are universally asymptomatic, except when the normal physiologic processes of the gland are encroached upon, producing obstruction of the duct. The obstruction, whether complete or partial, invites infection from the oral cavity. The symptoms are due to parotitis. Disturbance in function of the parotid may be due to abnormal stimulation of the auricular temporal nerve. The patient with Frey's syndrome notes that while eating the cheek becomes hot, flushed, moist with perspiration and hyperesthetic to touch.

In this series of seventy parotid tumors, thirteen patients (18 per cent) were operated upon two or three times. The average length of time between surgery and the recurrence of growth was six years. Surgery in all cases had previously been performed elsewhere, but whether recurrence really takes place or new embryonal cell rests are stimulated, one does not know. However, we do know that incomplete removal of the mixed tumor, leaving the capsule or epithelial element, promotes a tendency to recurrence and is the probable cause for it.

The type of surgery performed for a parotid tumor varies, depending upon the location of the tumor, its size and whether or not it is encapsulated. Thirty-eight of our patients (54 per cent) had simple enucleation of the tumor. When the tumor is outside the capsule, well encapsulated near the surface or on the surface of the parotid, simple enucleation is the safest and most adequate procedure. (Fig. 1.) When the tumor is deeply seated in the superfical lobe, only two surgical procedures can be considered adequate, preferably superficial lobectomy. This operation has the advantage of adequate removal of the tumor with less chance of recurrence. (Fig. 2.) The disadvantages are the dangers of injury to the facial nerve (which may be temporary or permanent paralysis), fistula from the remaining deep lobe and Frey's syndrome.

The second surgical procedure for a deep-seated tumor is partial lobectomy (Fig. 3) which removes the tumor and prevents recurrence. When the facial nerve has been visualized, the danger of injury to it is less. This procedure was used on eleven patients (15 per cent) with parotid tumors with no nerve injury. The complication of fistula is common unless the auricular temporal nerve, the secretory nerve, is severed. X-ray therapy may be used to seal the severed ducts and inhibit parotid gland activity during the healing phase.

Superficial lobectomy was performed three times, or in 4 per cent of the tumors, and in all three facial nerve injury occurred, although thought to be only temporary by the operating surgeon. Total parotidectomy was performed in six patients (8 per cent of the tumors). The nerve stimulator was used in three cases: one total parotidectomy, one partial lobectomy and one lobectomy. In two of these cases some nerve paralysis was observed postoperatively.

If the tumor is located in the deep lobe (Fig. 4), or the lesion is malignant or diffusely infiltrated through both lobes of the parotid (Fig. 5), total parotidectomy is the operative procedure of choice and the only one which will produce a cure. Certain lesions of the parotid are diagnosed only upon exploration and biopsy. Lesions which appear to be enlargements of the gland with no definite tumor on palpation, and which are variable in size and symptomatic should be studied by x-ray to rule out stones or calcification. Contrast dye studies of the duct, such as with the use of skiodan,® should be employed prior to surgical exploration or biopsy as a means of diagnosis. A case report of such a condition will be given. In our series of seventy cases, forty-six (65 per cent) were in the class of mixed tumors. Of

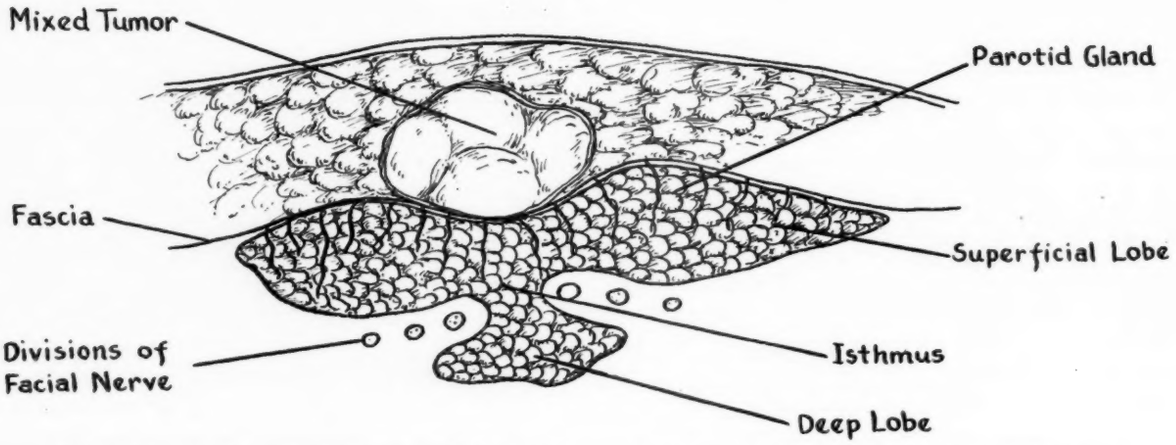

FIG. 1. The usual location of the so-called mixed tumors of the parotid in relation to the parotid gland.

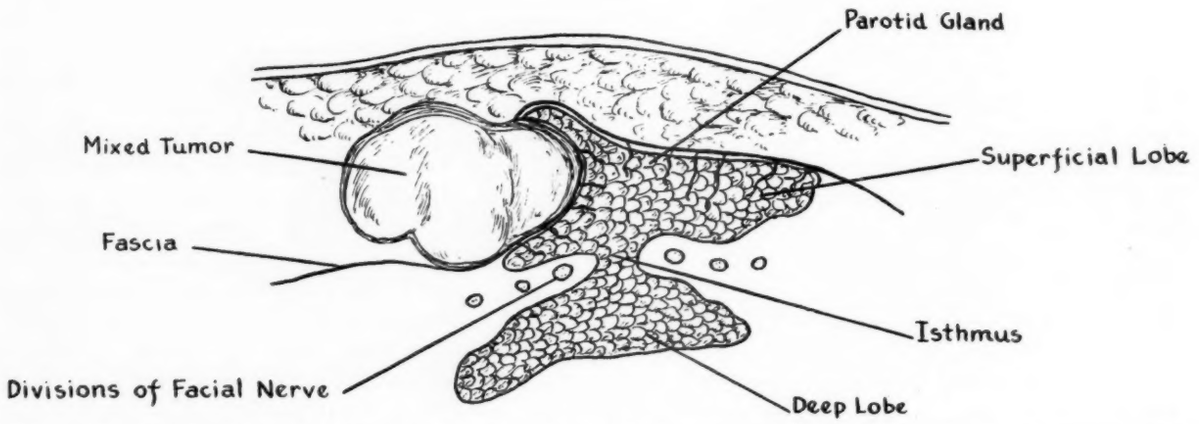

FIG. 2. The location of a mixed tumor of the parotid gland where superficial lobectomy, local excision or partial lobectomy may be used.

these forty-six cases, twenty-five presented the typical mixed tumors—well encapsulated and consisting of connective tissue and epithelial elements, but with no mitosis or evidence of malignancy. Twelve (26 per cent) were considered to be grade I malignancy; six (13 per cent) grade II; and three (6 per cent) grade III; the latter were definitely microscopically malignant. Four (5 per cent) of the patients had adenocarcinoma. Two of these patients had hopelessly malignant lesions which were too far advanced for surgical treatment other than the taking of a biopsy specimen. Carcinoma of the parotid is usually slow to metastasize, but is known to infiltrate and invade adjacent tissues. In this series, radical neck dissection was performed in two patients and no involved nodes were found on pathologic examination. There were two cases of sarcoma (2 per cent), which is a higher percentage than in most series; both occurred in patients over fifty years of age and microscopically were lymphosarcomas. Biopsy specimens were taken and x-ray therapy was administered, and to date there is no evidence of recurrence. Sarcoidosis of the parotid was found in three patients; all of these patients were thought to have mixed tumors. The lesions were well encapsulated and were easily removed by enucleation. No other lesions of a similar nature were found elsewhere after complete examination, chest x-rays and complete gastrointestinal studies of these patients. Tuberculin and Wassermann tests were negative. These lesions have been called granulomatosis lesions, although typically they are sarcoid lesions resembling tuberculosis. One patient with sarcoidosis received cortisone therapy. This patient presented a picture of general malaise and easy fatigability. A general

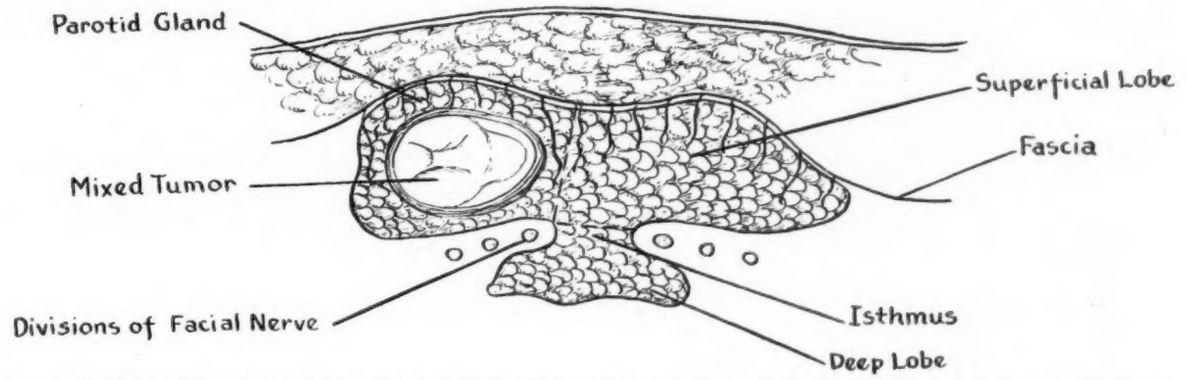

FIG. 3. The location of a mixed tumor of the parotid gland where superficial lobectomy or partial lobectomy may be used.

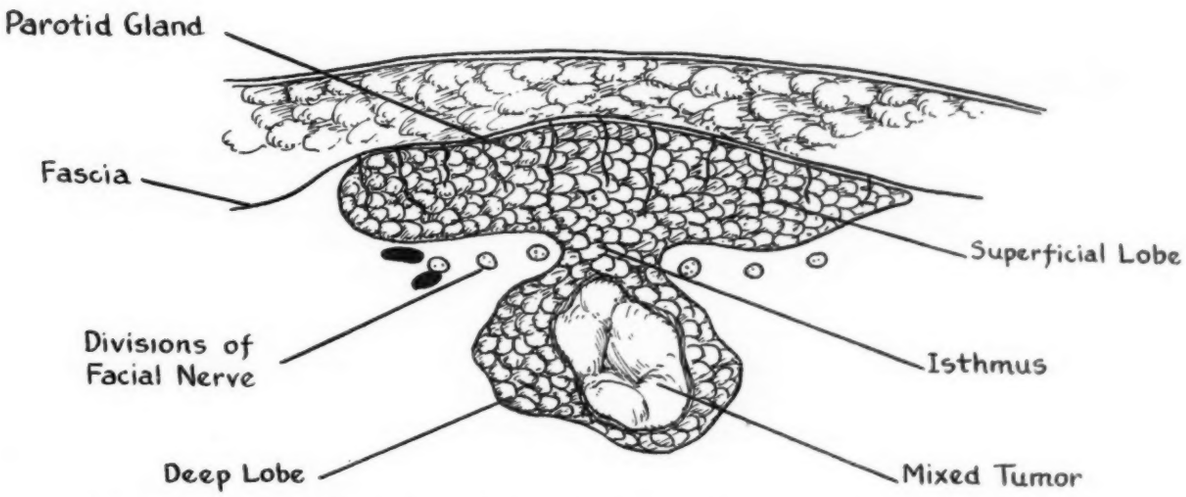

FIG. 4. The location of a mixed tumor of the parotid where only total parotidectomy will be successful.

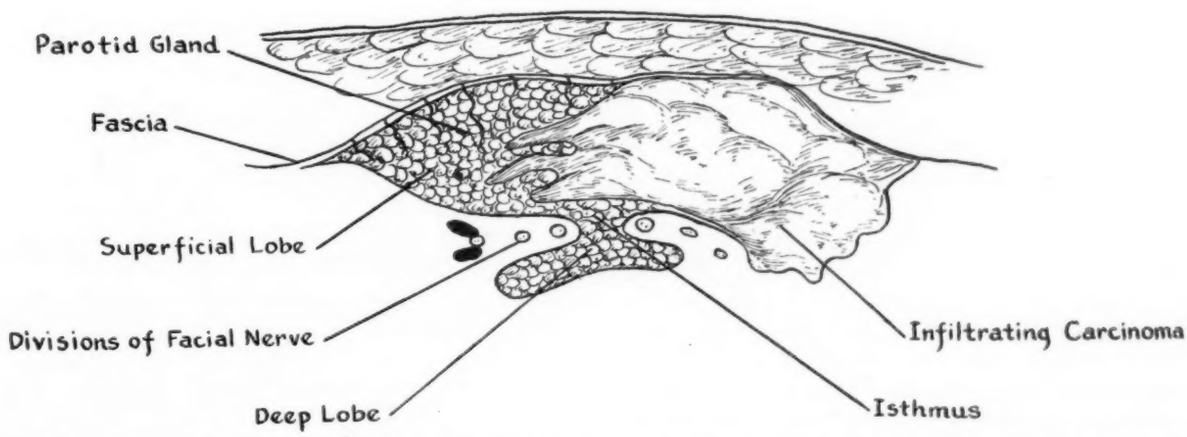

FIG. 5. Carcinoma of the parotid gland where total radical parotidectomy is indicated with or without radical neck nodal dissection.

FIG. 6. Postoperative lateral view of a patient after right total parotidectomy for chronic parotitis with calcinosis and Frey's syndrome.

feeling of well being was restored following the administration of cortisone. Among the other pathologic lesions found was arthritis of the temporomandibular joint.

One of my patients was referred for total parotidectomy for calcinosis and chronic parotitis, presenting typical Frey's syndrome. This patient's chief complaint was flushing of the cheeks, swelling and pain after each meal. There was a definite enlargement of the gland and an increased firmness, but no definite tumor mass could be palpated. X-ray examination revealed many rounded areas of calcium. Total parotidectomy was performed after isolation of the facial nerve, this being more difficult than usual due to previous surgery and marked inflammatory changes in the gland. The presence of a small amount of saliva from the wound postoperatively indicated some parotid tissue remaining. This fistula closed promptly after x-ray therapy. The patient has had no further symptoms since surgery. (Fig. 6.)

The complications observed in this series of seventy parotid tumors resulted in one death after radical resection which was obviously incomplete for carcinoma of the parotid. Death resulted from hemorrhage which closed off the pharyngeal airway. Suffocation occurred on the first postoperative day.

There were eight cases of partial and complete facial paralysis in this group, all of which were considered by the operating surgeon to be of a probable temporary nature. The surgeon explained that in all cases the nerve and the major branches were dissected out during surgery. The facial nerve poorly tolerates traction, hot packs, excessive stimulation and drying but may be handled gently and moved about without injury if traction is used. If one of the major divisions is cut, such as the temporal facial or cervical division, temporary paralysis will occur, but in many cases recovery is possible if the rami intercommunicantes (Fig. 7) between the peripheral branches are preserved in the dissection. To prevent temporary or permanent injury to the nerve, ligation of the external carotid artery will produce a less vascular field, hence less trauma to the nerve directly or indirectly by constant sponging. Hemorrhage occurred in two cases, one severe enough to cause death and the second severe enough to require blood transfusion. In treatment of carcinoma of the parotid, ligation of the external carotid certainly should be a must if more than total parotidectomy is contemplated, such as mandibular resection.

SURGICAL PROCEDURE FOR PAROTID TUMOR

Anesthesia. Although local anesthetic infiltration has been used successfully and has the advantage that the infiltration also acts as a hemostatic, I do not believe it has the advantage of general anesthesia with an intratracheal tube. With the latter type of anesthetic the patient is not restless and talkative during a long procedure and the surgeon is able to accomplish the anatomic dissection without worry about the patient's comfort. Stimulation and dissection of the nerve is uncomfortable to the patient under local anesthesia.

Skin Incision. The skin incision should be one of the standard incisions described by Bailey, Brown and many others, such as an inverted "W" or "J," starting just anterior to the ear at the superior margin of the zygoma, extending downward 1.5 cm. anteriorly to the external auditory meatus with the upper part of the incision only as deep as the subcutis, gradually deepening to expose the anterior margin of sternocleidomastoid muscles. The incision should not be made over the tumor mass unless the mass is located over the incision described. The skin flaps should be

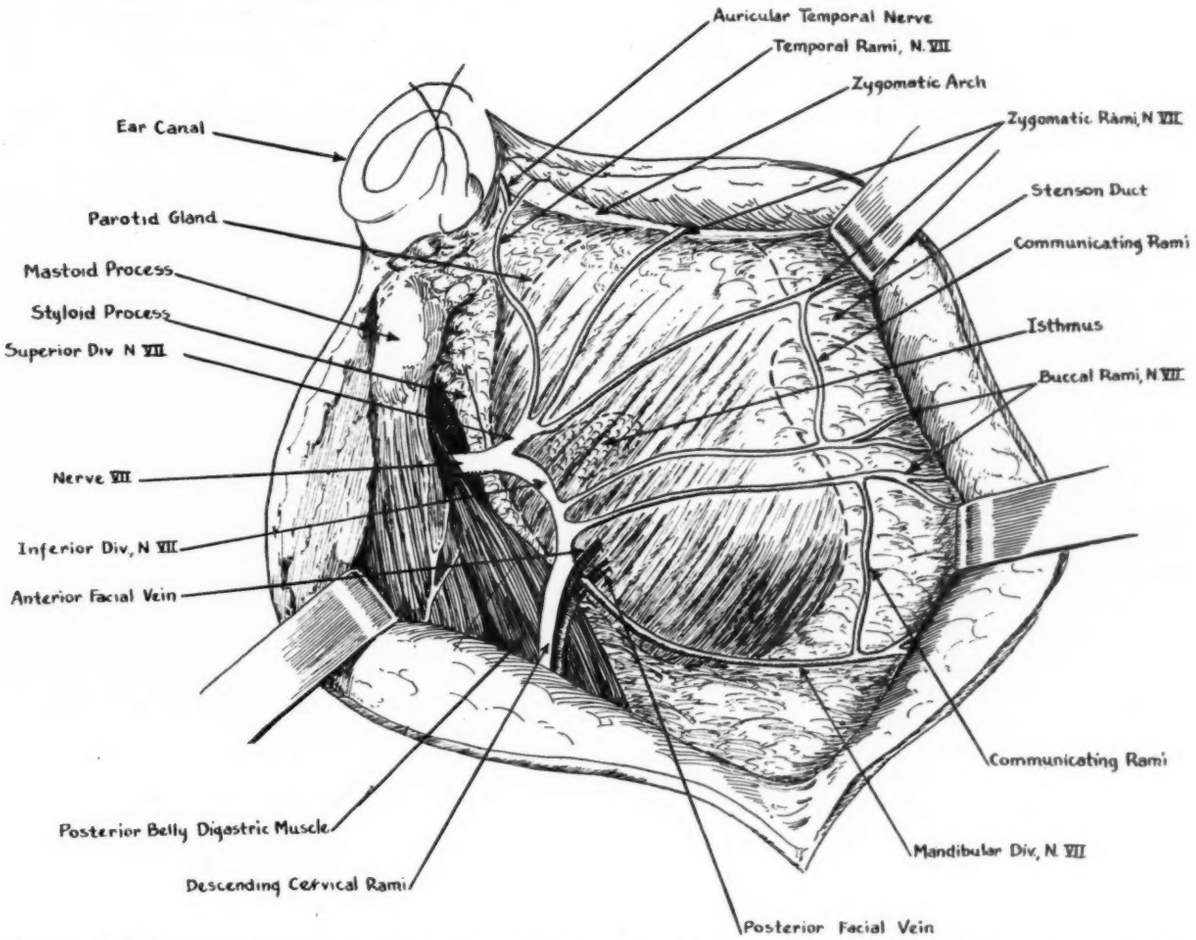

FIG. 7. This drawing demonstrates the location of the main trunk of the facial nerve in the fatty areolar tissue anterior to the styloid process, 1 cm. proximal and medial to the tip of the mastoid process and 2 cm. deep; and the peripheral anastomosis of buccal and zygomatic branches in 80 per cent of cases, and buccal and mandibular branches in 12 to 15 per cent.

adequately dissected both anteriorly and posteriorly to expose the entire parotid gland, the mastoid process and the upper portion of the sternocleidomastoid muscle.

Evaluating the Tumor. The tumor is next palpated to find if it is localized within or outside the capsule of the parotid and whether it is cystic or solid. If it protrudes outward, one can determine by dissection if there is a well developed capsule which can be easily enucleated; or if it is in the periphery of the gland whether a partial parotid gland excision can be accomplished. If the tumor is definitely deep within the lobe, the facial nerve must first be isolated and protected for superficial lobectomy, total parotidectomy or partial parotid excision. Anatomic considerations are very important. Bailey and others have worked on the basis that the parotid is a bilobed structure which is evident in the majority of cases and plays an important role in the dissection of the facial nerve. (Fig. 7.)

The Role of the Zygomatic Arch. The zygomatic arch is a good anatomic guide to the facial nerve. The zygomatic arch is not covered by the parotid gland and thus constitutes the most easily found point of orientation in dissection of the facial nerve branches. The shape of the parotid gland and also the quantity of glandular parenchyma varies considerably. The gland always stops on the lower edge of the zygomatic arch as a thin edge. The upper branches of the temporofacial division, temporal and zygomatic branches show the most constant position and development. These branches cross the zygomatic arch either at right angles or somewhat obliquely in the direction of the orbit. These nerves lie directly

on the periosteum. The zygomatic arch is the simplest and safest point of orientation. After location of these branches of the facial nerve, further dissection will demonstrate the two primary divisions of the nerve and main facial nerve trunk. (Fig. 7.)

Location of the Facial Nerve Main Trunk. The parotid is gently mobilized and the tip of the styloid process and the transverse process of the axis are identified by palpation. By dissection along the anterior border of the sternocleidomastoid, the facial nerve is exposed 1 cm. proximal and medial to the tip of the mastoid process 2 cm. deep at or just anterior to the stylomastoid foramen and in front of the styloid process. To improve exposure a portion of the mastoid process may be removed with an osteotome. Traction on the nerve at this level is very dangerous and should be avoided since the nerve is fixed at its origin. After the nerve is identified, dissection is carried forward and the various nerve branches identified and protected. (Fig. 7.)

Identification of the Facial Nerve. Identification of the facial nerve is accomplished by following the vascular channels approximately 1 to 2 cm. below the inferior portion of the parotid gland to identify the cervical facial nerve branch by identification of the posterior facial vein. Here the descending branch of the facial nerve divides to form the descending cervical ramus and marginal mandibular ramus. At this point the nerve lies in front of and runs parallel with the posterior facial veins, an important landmark. At this level the external carotid artery may be ligated. (Fig. 7.)

Denervation of the Parotid Gland. The auriculotemporal nerve, which is the secretory nerve, is severed to stop parasympathetic innervation. This was proved by Bernard and many others to prevent postoperative fistula and Frey's syndrome. Denervation of the parotid gland is accomplished simply by cutting all the branches of the auriculotemporal nerve as they approach the parotid gland, or by dividing the main trunk which lies between the edge of the mandible and the neck of the articular process of the mandible, and the cartilaginous funnel of the external auditory canal. This does not interfere cosmetically or injure the patient's general health status. (Fig. 7.)

Hemostasis. Hemostasis should be complete and under control at all times. The wound should be closed about a Penrose drain tubing, with accurate approximation of the wound edge, using subcutaneous sutures of fine catgut and wire, and No. 32 stainless steel interrupted sutures for a hairline closure. A pressure dressing is then applied. The drain is removed in two to three days and the sutures in five to seven days. There will be a loss of skin sensation for approximately two months.

SUMMARY

1. Seventy cases of parotid tumors treated at Spokane Hospital over a four-year period have been analyzed and summarized.

2. The surgical procedure of choice in treatment of parotid tumors depends upon the location of the tumor: whether localized within the parotid gland or outside of it, whether encapsulated or diffusely infiltrative. One operating upon parotid tumors must be qualified in the surgical procedures used and must have a thorough knowledge of the anatomy of the parotid gland, the facial nerve and the auriculotemporal nerve.

3. The true pathologic condition is revealed only by the microscopic pathology. Frozen section should be taken at the time of surgery to determine how radical the procedure must be to cure the patient of his disease.

4. The approach to treatment of various lesions has been discussed and outlined, and the classification of parotid tumors on microscopic examination has been analyzed.

5. All parotid tumors should be removed surgically as soon as discovered for the same reason that we recommend removal of breast tumors and solitary nodules of the thyroid; they are potentially malignant until proved by microscopic tissue study.

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Aneurysm of the Renal Artery

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ANEURYSMS of the renal artery are rare, 122 having been reported. In 1951 Abeshouse summarized 113 cases, and added two to the literature. Since then seven cases proved by operation have been described. In Table I the literature is brought up to date and one case is added. The fact that more aneurysms of the renal artery are being reported recently indicates an increased frequency of diagnosis.[1,2]

Males and females are equally afflicted (Table I), and the greatest incidence occurs during the fourth, fifth and sixth decades. (Table II.)

Classification. Aneurysms of the renal artery are similar to aneurysms elsewhere in the body. They may be classified in various manners: (1) Morris: spontaneous or traumatic; (2) Cowan: saccular, fusiform, dissecting or arteriovenous and (3) Gerald: true or false.

As is the case with aneurysms in general, their origin may be based upon a congenital anomaly, degenerative process, inflammation or trauma. It is interesting to note that only eighteen of the reported cases were associated with arteriosclerosis. The majority were true saccular aneurysms (Table I), only thirty-six false aneurysms having been reported.

Symptomatology. Aneurysms of the renal artery may express themselves in many ways. Pain and hematuria are the most common symptoms. (Table III.) Tenderness, a palpable mass, a bruit or pulsation may be present. Hypertension was present in twenty cases, of which two apparently had a permanent remission following operation. In two cases[2,3] the aneurysm ruptured during pregnancy with fatal results.

Diagnosis. Only twenty-six cases have been diagnosed preoperatively. As in the diagnosis of other rare conditions, an awareness of the disease is paramount. A careful consideration of the symptoms and physical findings may arouse suspicion, but a definite diagnosis must be made by further studies. Impaired unilateral renal function is usually present.

TABLE I
ANEURYSMS OF THE RENAL ARTERY (123 CASES)

No. of Cases	Author	Age (yr.)	Sex	Side	Classification	Site
115	Abeshouse (1951)[1]	9 mo. to 82 yr.	55 M 53 F 7 ?*	52 right 55 left 9† ?*	80 true 35 false	.....
1	Baker and Huckleberry (1952)[4]	24	F	Left	True	Intrarenal branch
1	Burket (1952)[5]	41	F	Right	True	Bifurcation of renal artery
1	Zummo et al. (1952)[6]	24	F	Left	?*	Renal artery
1	Salmon et al. (1953)[7]	14	F	Right	True	Renal artery
1	Hughes (1953)[8]	42	M	Right	True	Extrarenal branch
1	Hack (1953)[3]	33	F	Left	False	Renal artery
1	von Ronnen (1953)[2]	62	F	Right	True	?*
1	Silvis et al. (1954)	65	M	Right	True	Intrarenal; accessory renal artery

* Case histories incomplete.
† In one case there were bilateral aneurysms.

FIG. 1. Roentgenogram of abdomen showing the wreath-like or signet-ring calcification in the right kidney region; superimposed opaque calculi can be seen also (1954).

The most characteristic roentgenologic finding is a wreath-like, calcified mass in the kidney region. (Figs. 1 to 3.) Pyelograms may reveal a distortion of the renal pelvis or calyces. (Fig. 4.) Aortography may be a valuable procedure, particularly when a marked bruit and pulsating mass are present, but is usually not necessary.

Treatment and Surgical Considerations. Once the diagnosis is made, an evaluation of the function of the opposite kidney becomes most important. If the function of the other kidney is satisfactory, nephrectomy is the procedure of choice (Table IV), and should be recommended since the mortality in untreated cases is 30.7 per cent. In rare cases in which the function of the opposite kidney is not satisfactory and the aneurysm is extrarenal, aneurysmorrhaphy is indicated. Such a surgical procedure should be performed by those experienced in vascular surgery, and only upon patients whose expectancy of life outweighs the high mortality associated with this operation.

A transperitoneal approach is the method of choice since it enables the operator to clamp or ligate the renal artery at its base prior to dissection of the aneurysm. On the right, the renal artery may either be ligated or controlled with a tape, as desired, between the aorta and the inferior vena cava. In the case of large aneurysms involving the left renal artery, a transthoracic approach is advisable, particularly if repair of the aneurysm is to be attempted.

TABLE II
AGE DISTRIBUTION

Age (yr.)	No. of Cases
1 or less	1
1–5	1
5–10	1
11–20	3
21–30	16
31–40	9
41–50	25
51–60	29
61–70	20
71–80	5
81–90	2
Not stated	11

TABLE III
SYMPTOMS OF RENAL ANEURYSM (123 CASES)

Symptoms	No. of Cases	Incidence (%)
Pain	68	55
Hematuria	44	35
Palpable mass	32	25
Tenderness	24	19
Hypertension	20	16
Bruit	12	10

TABLE IV
PROGNOSIS

Treatment	No. of Cases	Mortality (%)
Palliative	47	30.7
Aneurysmorrhaphy and miscellaneous	20	60.0
Nephrectomy	56	5.3

CASE REPORT

A sixty-two year old, retired Marine was admitted to the U. S. Naval Hospital on January 7, 1954, with a four-day history of left lower abdominal pain, associated with nausea and vomiting and a change in bowel

FIG. 2. Lateral roentgenogram of abdomen revealing the calcification to be superimposed on the centrum of the first lumbar vertebra. Calculi are superimposed over the vertebral column (1954).

habits tending toward constipation. Physical examination revealed a moderately obese man. Tenderness and slight rigidity were present over the left lower abdomen. The temperature was 99.6° F., pulse 90, and blood pressure 190/120. The white blood cells were reported as 10,600 per cubic millimeter. Sigmoidoscopic examination was negative.

A clinical diagnosis of diverticulitis of the sigmoid colon was made. Conservative treatment, consisting of bedrest, a low residue bland diet and 250 mg. of terramycin® every six hours, resulted in a disappearance of all symptoms within one week.

A scout roentgenogram of the abdomen revealed a 4 cm. wreath-like calcification in the right renal area. (Fig. 1.) When confronted with this evidence, the patient furnished a phase of the history which he had previously concealed due to his fear of cystoscopy and operation. He had passed a right ureteral calculus in 1939, at which time his blood pressure had been 180/100. Subsequently, he had difficulty in passing each annual physical examination because of hypertension. In 1943 a scout film of the abdomen revealed a wreath-like calcification in the right renal area. (Fig. 3.) In 1947, because of his forthcoming discharge

FIG. 3. Plain film of the abdomen dated December 6, 1943, demonstrating the aneurysm with a break in the medial inferior aspect of the calcific ring.

FIG. 4. Retrograde pyelogram demonstrating the distortion of the superior calyx on the right by the aneurysm and showing its relationship to the pelvis (August 8, 1947).

from the U. S. Marine Corps, he was hospitalized for physical evaluation. His blood pressure then was 190/110. Intravenous pyelograms demonstrated a poorly functioning right kidney, with distortion of the superior calyx. An operation was recommended but the patient refused to give his consent.

Examination of the patient on January 15, 1954, failed to demonstrate a palpable mass,

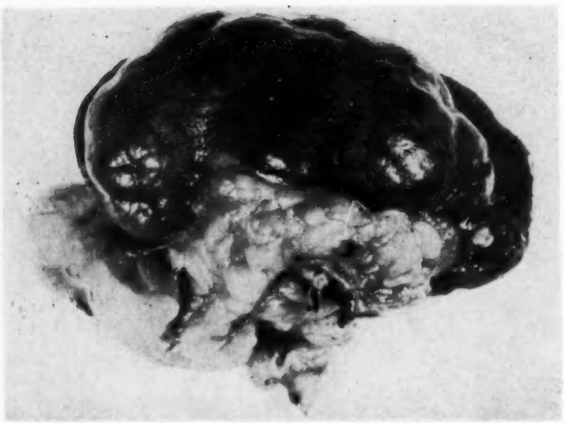

FIG. 5. An external view of the kidney revealing its small size and abnormal appearance. The ligatures are on the renal artery and vein. The aberrant vessel and ureter are not seen in this photgraph (1954).

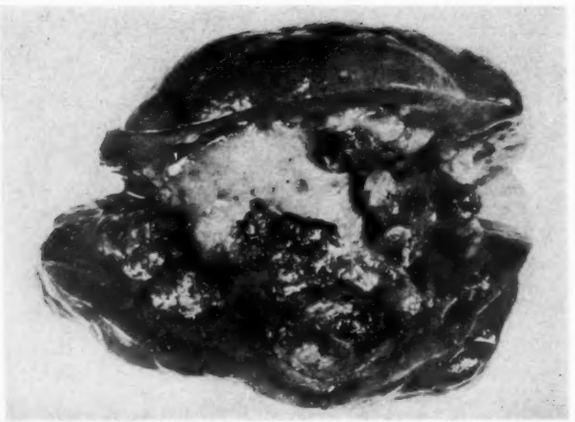

FIG. 6. View of kidney, partially transected, showing the pelvic collecting system filled with numerous large stones, and the calcified circular projection into the pelvic lumen.

FIG. 7. In this view of the kidney the aneurysm has been divided. Note the rigid calcified wall filled with an organized thrombus on the right and the more recent thrombus on the left.

pulsation or bruit over the right renal area. The blood pressure had remained constant at 190/120 despite sedation and bedrest. Intravenous pyelograms revealed a small, nonfunctioning right kidney. Urinary function studies proved that function of the left kidney was normal.

A diagnosis of aneurysm of the right renal artery was made, and nephrectomy was advised because of the persistent hypertension and the possibility of enlargement or rupture of the aneurysm.

Right nephrectomy was performed on January 19, 1954. A transperitoneal approach was elected to permit early control of the blood supply. The right renal artery was ligated in continuity between the aorta and inferior vena cava. An accessory renal artery arising from the aorta 2 cm. below the renal artery was divided and ligated. Dissection revealed a contracted, stone-filled kidney which completely surrounded the aneurysm. The kidney was removed in a routine manner. During the operation the measured blood loss was 250 ml. and the patient received 500 ml. of whole blood. A 20 mm. drop in both the systolic and diastolic blood pressures occurred, and persisted.

Postoperatively the patient's course was uncomplicated and was characterized by a constant, marked decrease in blood pressure. The mean blood pressure for three weeks postoperatively was 130/80, the highest being 150/90 and the lowest 120/72.

Pathologic examination showed a contracted kidney weighing 125 gm., with a granular external surface. (Fig. 5.) Upon sectioning the kidney, the pelvis was filled with numerous large calculi and a 4 cm. oval calcified mass protruded into the pelvis. (Fig. 6.) A section of this mass disclosed a true saccular aneurysm filled with an organized thrombus. (Fig. 7.) When the thrombus was removed the communication with an artery, which proved to be the accessory renal artery, was discovered. (Fig. 8.) The accessory renal artery was markedly sclerotic.

COMMENTS

This patient had a true saccular aneurysm of an accessory renal artery resulting from arteriosclerosis. The lesion had been demon-

FIG. 8. View of kidney with the organized thrombus removed and the aperture between the aberrant artery and the aneurysm demonstrated.

strated by x-ray eleven years previously. Associated was persistent hypertension of fifteen years' duration, which suddenly disappeared following nephrectomy. The "Goldblatt kidney syndrome" is a strong possibility in this case, but cannot be proved until the decrease in blood pressure has persisted for two years. This is the twentieth reported case of aneurysm of the renal artery with associated hypertension, and the nineteenth due to arteriosclerosis. It is the first report of an aneurysm of an accessory renal artery. Renal artery aneurysms have been diagnosed preoperatively in twenty-six instances. The wreath-like calcified mass in the renal area seen in the roentgenogram is of primary importance in the diagnosis. Preoperative diagnosis alerts the surgeon to study the function of the opposite kidney and to plan the operative approach and procedure with intelligence.

SUMMARY AND CONCLUSIONS

1. One hundred twenty-two reported cases of aneurysm of the renal artery are reviewed, and one case is added to the literature.

2. The etiology, pathology, age incidence, symptomatology and prognosis of aneurysm of the renal artery in 123 cases are tabulated.

3. The physiologic and surgical import of this lesion is discussed.

4. Nephrectomy is the surgical procedure of choice, provided that function of the opposite kidney is satisfactory. If the function of the opposite kidney is grossly deficient and if the aneurysm is threatening the life of the patient, aneurysmorrhaphy is indicated.

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Unusual Causes of Free Intraperitoneal Air in Acute Conditions of the Abdomen

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WHEN free abdominal air was first described as a roentgen sign, much emphasis was placed on its association with perforated peptic ulcer. This relationship is now well recognized. However, other causes of pneumoperitoneum are frequently not considered when this roentgen sign is encountered in an acute condition of the abdomen. Approximately 25 per cent of the cases of free intraperitoneal air in acute conditions of the abdomen will be due to causes other than perforated ulcer. This communication will present those causes of pneumoperitoneum and will show that in some of the cases differentiation from perforated gastric or duodenal ulcer is possible. A complete list of lesions associated with pneumoperitoneum from the literature and our experience is included.

Although the occasional presence of pneumoperitoneum has been recognized, this sign was of no diagnostic importance until the use of radiology became common. In 1915 Popper[26] cited a case of peritonitis with free air and suggested that x-ray might be of value in diagnosing gastrointestinal perforations. In 1916 Lenk[17] discovered the roentgen finding of free intraperitoneal air in fresh abdominal bullet injuries. In 1917 Martin[18] described pneumoperitoneum in association with perforated duodenal ulcer. This same year Dandy[9] observed pneumoperitoneum in a patient suffering with a perforated typhoid ulcer of the transverse colon. Subsequently (1919) he described the x-ray determination of pneumoperitoneum as a method of diagnosis of perforations of the gastrointestinal tract.

In 1929 Pendergrass and Kirk[25] listed the following as possible causes of apparent pneumoperitoneum: (1) subphrenic abscess with gas, (2) transposition of viscera, (3) hepatoptosis with colon between the liver and diaphragm, (4) perforated duodenal ulcer and (5) pneumoperitoneum following laparotomy. Since their report, however, a great many additional causes have been described.

A review of the literature discloses the following: (1) perforated benign ulcerations of the stomach and duodenum;[18,34,35] (2) perforated malignancies anywhere in the gastrointestinal tract;[24,34] (3) perforated ulcerations of the bowel due to (*a*) typhoid,[9,34] (*b*) tuberculosis,[24,33] (*c*) regional enteritis,[12] (*d*) ulcerative colitis[16] and (*e*) foreign body;[6] (4) ruptured appendix;[16,34] (5) ruptured Meckel's diverticulum;[32] (6) ruptured diverticulum of colon;[20] (7) following laparotomy;[3,8] (8) following gastroscopy;[5,21,22,30] (9) following Rubin test;[29] (10) following knee-chest position exercises in the postpartum female;[11,33] (11) following use of a douche;[11] (12) trauma to the rectum or sigmoid with enema tube or other instrument; (13) blunt trauma to the abdomen; (14) pneumatosis cystoides intestinalis;[13,32] (15) perforations of the bowel due to obstruction;[2,4,24,27] (16) idiopathic perforation of the bowel;[10] (17) idiopathic perforation of the stomach;[23] (18) following therapeutic pneumothorax;[14] and (19) intraperitoneal abscess with gas-forming organisms.[25,29,36]

Pneumoperitoneum has also been associated with tonsillectomy,[28] pharyngeal diverticulectomy,[7] pulmonary bullae[14] and pneumonia.[19,31] Here the causal relationships are not so clear. There is also a small group of cases termed spontaneous or idiopathic pneumoperitoneum with no demonstrable cause for the condition.[1,2,15,24,33] Dodek and Friedman[11] have shown that most of these cases had an obvious

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etiology not diagnosed for one reason or another.

It should be kept in mind that a small segment of the population has air introduced therapeutically into the abdomen for the treatment of tuberculosis. Such persons may occasionally be encountered with acute conditions of the abdomen, making the differential diagnosis even more difficult.

CASE REPORTS

We have encountered thirty-two cases of spontaneous pneumoperitoneum in this hospital associated with acute conditions of the abdomen during the last five years. Twenty-one of these were perforated duodenal ulcers, and two were perforated gastric ulcers. The other nine cases were disorders that are frequently not considered when free air is encountered in an acute abdominal condition. The tenth case, from another hospital, is included for the sake of illustrative completeness.

CASE I. R. C. J. (R. 39 183), a twenty-eight year old white man, was first admitted to the hospital on October 3, 1952, with a history of generalized abdominal distress, experienced especially in the epigastrium, of two weeks' duration. He obtained symptomatic relief with antacids. Five days previous to admission he became somewhat more anorexic and noted sharp intermittent epigastric pains two hours after eating. During the patient's work-up on the Medical Service severe generalized abdominal pain suddenly developed. Examination revealed a board-like abdomen with generalized tenderness and rebound tenderness. Bowel sounds were absent.

Laboratory data revealed the following: white blood cells 11,400, stabs 3, neutrophils 45, lymphocytes 39, monocytes 8, eosinophils 5. Urinalysis was normal. An upright x-ray film of the abdomen revealed air beneath both domes of the diaphragm and diffuse haziness over the abdomen probably due to peritonitis.

A diagnosis of perforated peptic ulcer was made, and operation was performed. At surgery a perforation on the anterior surface of the stomach at the greater curvature, measuring approximately 6 mm. in diameter, was found. The area surrounding the perforation was markedly indurated and was felt to be neoplastic tissue. Numerous enlarged lymph nodes were present in the greater and lesser omentum. Subtotal palliative resection was performed. Pathologic report of the tissue removed was lymphosarcoma. The patient recovered from surgery without great difficulty, but a few weeks postoperatively his course started rapidly downhill, and he died on November 25, 1952.

Comment. This case represents an example of an intra-abdominal catastrophe with true "board-like" rigidity and the absence of peristalsis. Because the material spilled was highly irritative gastric juice, there was no distinguishing factor on physical examination between this case and one of perforated gastric or duodenal ulcer. The fundamental pathology, however, was that of a perforated neoplasm.

CASE II. J. N. W. (R. 24 473), a forty-nine year old man, entered the hospital on September 16, 1947, for treatment of reticulum cell sarcoma of the nose. During the course of radiation treatment to his nose, sudden, severe, generalized abdominal pain developed.

Physical examination revealed generalized board-like rigidity of the abdomen, together with diffuse and rebound tenderness. Bowel sounds were absent. Liver dullness was not obliterated. On rectal examination there was fullness in the cul-de-sac which was exquisitely tender to palpation.

Laboratory data were as follows: white blood cells 19,250, neutrophils 90, lymphocytes 6, monocytes 4. Upright x-ray examination of the abdomen revealed free air beneath the left diaphragmatic leaf. A diagnosis of perforated abdominal viscus was made. At laparotomy a perforation through tumor tissue, which had infiltrated the anterior wall of the stomach, was found and closed.

Comment. As in Case I, this patient suffered from a perforated neoplasm of the stomach; however, he was being treated for reticulum cell sarcoma of the nose, and with such a diagnosis the true etiology of the perforation could have been suspected.

The extreme state of rigidity and absent bowel sounds again pointed to a high perforation in the intestinal tract.

CASE III. L. S. (R. 25 114), a twenty-five year old white man, was admitted to the hospital on December 14, 1947, seven hours after an auto accident. The patient was suffering from severe generalized abdominal pain, which developed shortly after the accident.

Physical examination revealed generalized

board-like rigidity of the entire abdomen with marked tenderness to palpation and rebound tenderness. Peristalsis was absent to auscultation.

Laboratory data were as follows: white blood cells 15,800, neutrophils 84, lymphocytes 16. Urinalysis showed albumin 1+, and 8 to 10 white blood cells per high power field; red blood cells were too numerous to count. X-ray examination of the abdomen in the upright position showed the right dome of the diaphragm to be elevated, and free air was visualized beneath the right and left leaves.

The patient was taken to the operating room with a preoperative diagnosis of ruptured viscus. A laceration of the jejunum, 12 inches from the ligament of Treitz on the antimesenteric border, was found and closed. The patient's postoperative course was uneventful.

Comment. This case represents another example of an extreme degree of peritoneal irritation. Although the perforation was not gastric or duodenal, it still was high enough in the gastrointestinal tract for the bowel content to be very irritating, giving board-like rigidity. Traumatic perforation of the small bowel is not common, but when it does occur, the location is usually at or near points of fixation.

Case IV. R. M. (R. 40 205), a 54-year-old white man with exudative pulmonary and genitourinary tuberculosis, fainted on October 20, 1949, while a patient in the hospital. Following this fainting episode he complained of vague abdominal distress. There was no nausea or vomiting.

Physical examination revealed increased resistance to palpation with generalized tenderness and moderate rebound tenderness.

Laboratory data were as follows: white blood cells 5,000, neutrophils 61, lymphocytes 39. Urinalysis 15 to 20 white blood cells per high power field, rare red blood cells, occasional hyaline cast. X-ray examination of the abdomen in the supine and erect positions revealed air beneath both domes of the diaphragm.

A diagnosis of perforation of the small bowel was made and laparotomy performed. Several areas of "annular constriction" with fibrin deposits on the serosal surface of the small bowel were found. These appeared to involve Peyer's patches. At one such area near the lower jejunum a minute perforation was found on the antimesenteric border of the bowel. This was closed with a single layer of sutures. The postoperative course was uneventful. Although the small portion of tissue submitted to the pathologist was reported as showing only acute inflammation, it was believed by the surgeon that this process was tuberculous in nature.

Comment. This patient's symptoms and physical findings indicate a milder degree of peritonitis than the previous three cases. The perforation was lower in the jejunum. The significant pathologic physiology in this case was undoubtedly the small size of the perforation which permitted release of only a small amount of intestinal material, which was not highly irritative.

Case V. J. V. M. (R. 42 684), a thirty-four year old white man with known pulmonary tuberculosis, developed vague generalized cramping pain on January 8, 1954. He had no nausea or vomiting and continued to eat until the evening of January 10, 1954, when he refused his tray. At this time he was examined by a member of the Surgical Service.

Physical examination revealed that the abdomen was diffusely tender. There was no rebound tenderness or muscle rigidity. Peristalsis was recorded as normal or slightly diminished. Rectal examination was noncontributory.

Laboratory data were as follows: white blood cells 7,300, neutrophils 65, lymphocytes 33, eosinophils 2. The sedimentation rate was 21 mm. per hour. Urinalysis was normal. X-ray examination of the abdomen in the upright position showed free air beneath both domes of the diaphragm and a gas-filled loop of small bowel in the left upper quadrant.

A diagnosis of tuberculous enteritis with perforation was made, and exploratory laparotomy performed. Upon opening the abdomen a distended loop of ileum presented itself. The wall was thickened and reddened over a distance of about 6 inches. The serosal aspect of this segment of bowel and the adjacent mesentery were studded with numerous small gas bubbles. These measured up to 1 cm. in diameter. No perforations were seen through the bowel wall. The grossly involved segment of bowel was resected, and the patient made an uneventful recovery. The pathologic diagnosis was regional enteritis.

Comment. This case represents the type of perforation occasionally found in regional enteritis, that is, perforation of the mesenteric border of the bowel. Soilage of the peritoneal

cavity had not occurred since leakage was into the mesentery.

CASE VI. R. W. B. (R. 27 146), a twenty-nine year old man, entered the hospital on September 26, 1948, with severe, generalized abdominal pain of twenty-four hours' duration. Early in the course the pain was cramping in nature and accompanied by diarrhea. An enema given nine hours before admission increased the severity of the pain.

Physical examination revealed an acutely ill patient with marked increased resistance over the entire abdomen. Tenderness was most marked in the paraumbilical region. An upright x-ray film of the abdomen revealed free air under the right leaf of the diaphragm.

A diagnosis of intestinal perforation was made, and operation performed. At surgery a gangrenous loop of ileum with perforation was found and removed. Etiology of the gangrene was an adhesive band causing a volvulus. The postoperative course was uneventful.

Comment. This patient represents the picture of severe peritonitis. Observation in this and other cases indicates to us that material from a strangulated and perforated loop of small bowel produces marked rigidity. In this case the increase of paraumbilical tenderness was suggestive of small bowel involvement.

CASE VII. H. Z. B. (R. 34 362), a thirty year old white man, entered the hospital on June 2, 1951, stating that he had become ill one week previously. He first noticed vague epigastric cramps and anorexia. The following day the pain shifted to the right lower quadrant of the abdomen where it persisted for the following six days. On the morning of admission he was awakened by sudden severe exacerbation of his right lower quadrant pain. This steadily became worse and generalized.

Examination of the abdomen disclosed generalized tenderness and rigidity with maximum tenderness present on the right side. Rebound tenderness was present in the lower abdomen. No masses were felt, and peristalsis was absent.

Laboratory data were as follows: white blood cells 7,950, neutrophils 83 with 47 band forms, lymphocytes 10, monocytes 7. Sedimentation rate was 37 mm. per hour. Urinalysis, 5 to 8 white blood cells per high power field. X-ray examination of the chest and abdomen showed bilateral subdiaphragmatic free air in the upright position.

A diagnosis of ruptured appendiceal abscess was made, and laparotomy was performed. Purulent peritonitis was found in the right lower quadrant with exudate extending up the right paracolic gutter. The distal two-thirds of the appendix were necrotic with a perforation at the tip, and a fecalith was found free in the peritoneal cavity. The appendix was removed with as much purulent material as possible. Recovery was satisfactory after a somewhat stormy postoperative course.

Comment. This is the case of a patient with purulent and fecal material in the peritoneal cavity. He had been ill for one week, yet never showed the acute symptoms and board-like rigidity of the sudden rupture of the stomach, duodenum or upper jejunum. History and physical examinations were typical of appendicitis, and a differential diagnosis was not difficult.

CASE VIII. G. R. B. (R. 42 032), a thirty-three year old white man with known pulmonary tuberculosis, entered this hospital on June 28, 1953, complaining that twelve hours prior to admission sharp pain had developed in the right lower quadrant, disappearing in about fifteen minutes. Cramping right-sided abdominal pain then gradually developed and localized in the right upper quadrant. The patient vomited once, five hours after initial onset. In order to relieve his distress the patient had tried to move his bowels by giving himself an enema, which caused severe lower abdominal pain.

Physical examination revealed generalized abdominal tenderness and mild voluntary resistance to palpation. The signs were most marked on the right side. Bowel sounds were normal. Rebound tenderness was absent. Rectal examination showed only generalized tenderness.

Laboratory data were as follows: white blood cells 29,600, neutrophils 87, lymphocytes 12, monocytes 1. Urinalysis, 4 to 5 white blood cells per high power field, 6 to 8 hyaline and granular casts per low power field. X-ray films of the abdomen revealed air beneath the right hemidiaphragm.

A diagnosis of tuberculous enteritis with perforation of the intestinal tract was made. At laparotomy a small perforation of the sigmoid colon was found, and a Mikulicz resection was performed. This perforation was about 1 mm. in diameter, 12 inches above the rectosigmoid junction, and fecal material was leaking from it.

A partly walled-off abscess was found in the pelvis. Histologic examination and cultures failed to reveal any underlying etiologic agent. The patient's postoperative course was uneventful.

Comment. This patient had fecal contamination of the lower peritoneal cavity, yet there was no rebound tenderness and peristaltic activity was normal. Although the peritoneum was highly contaminated, the peritonitis here appeared to be not nearly so severe as that from a perforation higher in the gastrointestinal tract. From history and location of the lesion, an enema tip perforation was highly suspected.

CASE IX. F. T. P. (R. 39 904), a sixty-four year old white man, was admitted to the hospital on December 8, 1952, with severe generalized abdominal pain. He gave a history of chronic constipation with lower abdominal discomfort. The evening before admission he had sought medical advice elsewhere and was given an enema by rectal tube. Severe abdominal pain appeared suddenly during defecation following the enema.

The patient was in shock and markedly dehydrated. Examination of the abdomen showed generalized tenderness. Voluntary guarding and moderate rigidity were present in the lower quadrants.

Laboratory data were as follows: white blood cells 7,900, neutrophils 85, lymphocytes 14, monocytes 1. Urinalysis showed albumin 2 +, 5 to 7 white blood cells per high power field, 20 to 25 red blood cells per high power field and numerous finely granular casts. The serum amylase was reported as 51 Somogyi units. An upright x-ray film of the abdomen revealed free air beneath the right dome of the diaphragm.

Because of the x-ray finding of free air under the diaphragm, a tentative diagnosis of perforated peptic ulcer was made. Following partial correction of dehydration and stabilization of blood pressure, the patient was operated upon. Free feces were found in the peritoneal cavity. It was necessary to extend the incision downward to repair a 3 cm. laceration of the sigmoid immediately above the peritoneal reflection. Proximal colostomy was done. Recovery was uneventful.

Comment. In this case the finding of free air beneath the diaphragm caused an unmerited disregard of history and physical findings to the extent that a misplaced incision was made. A language barrier caused the history to be less clear than desirable, but the physical findings should have been highly suggestive.

In this patient widespread soiling of the peritoneal cavity with feces again showed a lack of extreme tenderness and board-like rigidity. Perforation was undoubtedly due to the enema tube. The incision should have been placed in the mid-abdomen for ready extension upward or downward as indicated.

CASE X.* J. R. (Denver General Hospital 291 473), a sixty-two year old white man, entered the Denver General Hospital on April 21, 1953, with the chief complaint of sudden onset of lower abdominal pain on the day of admission. The pain became steadily worse and was located in both lower quadrants and in the left upper quadrant of the abdomen. It finally localized in the right lower quadrant below the umbilicus. There was no nausea, vomiting or hematemesis. No history of ulcer was obtained.

On physical examination tenderness to deep palpation was present in the right lower quadrant and in the mid-abdomen below the umbilicus. There was rebound tenderness throughout the abdomen. Bowel sounds were present, but hypoactive. Rectal examination showed tenderness high on both sides and in the midline when palpating the pelvic peritoneum.

Laboratory data revealed 14,100 white blood cells, with a normal differential count. Urinalysis showed 3 + sugar, with a trace of acetone. Microscopic appearance was within normal limits. X-ray of the abdomen showed free air in the right subdiaphragmatic area.

Exploratory laparotomy was performed on the day following admission. A ruptured diverticulum of the sigmoid colon was found. This was closed and left-sided colostomy of the sigmoid colon, superior to the rupture, was made. The patient eventually recovered following a complicated postoperative course.

Comment. This represents another case of a man who, although he had a ruptured colon and fecal contamination of the peritoneum, did not show signs of severe peritoneal irritation.

COMMENTS

In this series, 28 per cent of those cases of pneumoperitoneum associated with acute abdominal emergencies were due to causes other than perforated gastric or duodenal ulcer. This roughly agrees with the percentage recorded

* Case contributed by Dr. Charles MacGregor, Denver General Hospital, Denver, Colorado.

by other authors: Kornblum[16] reports eleven of thirty-five cases of pneumoperitoneum as involving organs other than stomach or duodenum. In nine of the ten reported cases, review of history and physical examination shows enough points to suspect a condition other than a perforated peptic ulcer.

A perforation with abrupt spilling of a considerable quantity of fluid from the stomach or duodenum in cases of peptic ulceration soils the peritoneum with highly irritating juices. These cases give rise to the extremely rigid abdomen. However, the spillage of material low in the gastrointestinal tract, while high in bacterial count, is not so immediately irritating; and the complaints of the patient and the physical findings are those of a much less rigid abdomen with less severe pain. Slow leakage of a small amount of fluid from any viscus can probably change the picture, giving rise to much less severe symptoms and signs.

One should be on guard against the erroneous diagnosis of appendicitis in the perforated ulcer patient with predominant signs in the right lower quadrant. This has been previously emphasized by Lord Moynihan. Our experience shows, however, that one can have, rarely, a perforated appendix with free air.

It will be noted from the case reports that even in the presence of peritonitis of hours' or days' duration, the total white cell count will often be normal. The differential count appears to be more significant in these cases, but nevertheless not completely reliable.

As has been pointed out in the case reports, one may suspect the site of the trouble and make the incision accordingly. In cases in which the abdomen is not quite so rigid as is usually seen in ruptured peptic ulcer, it would be well to place the incision in such a position that it can be readily extended up or down, depending upon the actual lesion found at laparotomy. In general, it is believed that for emergency abdominal cases in which the diagnosis is uncertain, the vertical incision should be used. This incision is more easily extended to expose trouble located in an unexpected position in the peritoneal cavity.

SUMMARY

Of thirty-two cases of spontaneous pneumoperitoneum with acute abdominal conditions, nine were found to be due to causes other than ruptured peptic ulcer. Reports are made on these nine cases; Case x, from another hospital, is included for illustrative completeness.

Approximately 25 to 30 per cent of cases showing free air under the diaphragm are due to causes other than ruptured peptic ulcer. A review of the literature is made compiling a complete list of these causes.

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Carcinoid Tumors of the Rectum

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CARCINOID, or argentaffin carcinoma, is one of the most interesting tumors of the gastrointestinal tract, especially in regard to the question of its malignancy. These neoplasms occur quite infrequently; when they do, they are usually found in the appendix or adjacent ileum. Recently, more carcinoids have been reported in the literature than in previous years. In spite of this, carcinoid neoplasms of the rectum remain uncommon. Because of this, and the variety of ways in which these tumors manifest themselves, six cases of rectal carcinoids will be reported which have been treated on the Surgical Service of this hospital during the past several years.

In 1838 Merling reported the first case of a carcinoid. The case was reported as carcinoma of the appendix, but subsequent review of his case presentation strongly suggests that the tumor was actually a carcinoid.[6] Lubarsch, in 1888, was the first to describe these tumors in detail. It was his impression that they were primary carcinomas of the bowel originating from the crypts of Lieberkühn.[17] In 1907 Oberndorffer reported six such neoplasms occurring in the appendix, and suggested the term "carcinoid," believing these tumors were benign despite their resemblance to carcinoma.[17] In 1910 Hubschmann showed that these neoplasms arose from the "gelben zellen" (argentaffin cells) of the intestinal tract.[6] In 1914 Gossett and Masson, using a silver impregnation technic, noted a remarkable affinity for silver salts displayed by the intracytoplasmic granules of these tumor cells. They suggested the tumor be called "argentaffin tumor." It was thought that the cell of origin displayed an endocrine function. It was their belief that the tumors arose from the Kultschitzky cells of the intestinal tract.[29]

Many theories have been proposed concerning the origin of these tumors. Because of the lack of substantial evidence, the majority of these theories have been discarded. Five theories remain prominent: These tumors originate from (1) the crypts of Lieberkühn (Lubarsch, 1888); (2) the basal cells of the intestinal glands, as in basal cell carcinoma of the skin (Bunting, 1904); (3) nests of pancreatic exocrine tissue (Trappe, 1907) or islet cell tissue (Toeniessien, 1910); (4) the argentaffin cells of the intestinal mucosa (Gossett and Masson, 1914); (5) displaced embryonic glands of Lieberkühn (Adrikassef, 1922).[6,26]

Since Horn and other authorities have demonstrated that not all rectal carcinoids contain argentaffin granules and that some contain mucin, it seems that the term carcinoid is probably as good as any, particularly since the malignant potentiality is well recognized, but extremely variable.

Incidence. It is difficult to evaluate accurately the incidence of carcinoids because of the relative sparsity of reported statistics on the subject. They may occur wherever Kultschitzky cells are present, i.e., throughout the entire gastrointestinal tract. Ariel reports the evaluation of 2,373 gastrointestinal tract neoplasms of all types. Of these, 1.3 per cent were carcinoids.[29] Porter and Whelan state that a carcinoid of the appendix is discovered once in every 200 to 500 appendectomies.[22] Pearson and Fitzgerald reviewed 140 carcinoids; ninety-eight (70 per cent) occurred in the appendix, and forty-two (thirty per cent) were non-appendiceal in origin. None of the appendiceal carcinoids showed regional node involvement or distant metastases. Sixteen (38 per cent) of the non-appendiceal tumors showed evidence of metastases. Sixty-four per cent of the non-appendiceal carcinoids occurred in the ileum and of this group, 37.9 per cent showed metastases. Carcinoids occurred ten times more frequently in the appendix than in the ileum in this study. Twenty-seven per cent of the carcinoids found in surgical specimens were discovered in the appendix.[21] Porter and Whelan

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reported seventy-two carcinoids found in 26,384 appendectomies performed at Boston City Hospital between 1910 and 1937. This gives an incidence of 0.28 per cent.[21,22] Reynolds and Cantor reported that the incidence of metastases from non-appendiceal carcinoids is variously recorded between 18.3 and 52 per cent.[24] At Johns Hopkins Hospital, twenty-nine carcinoids were found in 62,000 necropsy and operated cases.[27] Of 5,745 autopsy specimens and 41,300 surgical specimens examined at Mt. Sinai Hospital, thirty-one were carcinoids.[27] Yaker reported two rectal carcinoids in 13,809 routine autopsies.[31] Hines and Riddler reported three rectal carcinoids in 30,000 routine proctologic examinations.[13] Stout reported twenty carcinoids of the large intestine plus six of the rectum.[14] Horn reported six carcinoids originating in the rectum, two of the transverse colon and five of the cecum and ascending colon.[14] Foreman has reported thirty-eight carcinoids of the gastrointestinal tract. Of these, nineteen occurred in the appendix, fourteen in the small bowel and five in the rectum.[11] In a rather recent report Epps and his associates reviewed the literature and found a total of seventy-two rectal carcinoids.[9] Since the publication of this report, Tavenner et al.[29] have reported seven more rectal carcinoids; Foreman[11] has added five cases; Freund,[12] two cases; and Cohen, one case.[5] in 1953 Kunkel, Waugh and Dockerty of the Mayo Clinic reviewed the literature and found 103 reported cases of rectal carcinoids, ninety-two of which had been reported in the last twelve years. The authors added one case.[16] Another case has been added by Diffenbaugh, et al.[7] The total of rectal carcinoids now reported in the literature is approximately 105. With the addition of the six cases reported herein the total rises to 111. That the lesion is probably more common than this is indicated by the discovery of ten rectal carcinoids by Ehrlich and Hunter in a series of 813 gastrointestinal tumors from patients of "military age" group during World War II.[5]

Clinical Manifestations. Carcinoid tumors of the rectum may manifest themselves in various ways; however, the majority are asymptomatic. The incidence of occurrence of symptoms from these tumors is variously recorded between 17 and 34 per cent.[18,24,27] In the five cases reported by Foreman, four were asymptomatic, being discovered either at the time of autopsy or on routine proctologic examination. The fifth patient had symptoms referable to his rectum and was found to have a malignant carcinoid.[11]

A patient may die of another disease and have the tumor found incidentally at autopsy, or death may result from extensive tumor growth and again the true nature of the tumor may only be revealed at autopsy. The tumor may be discovered unexpectedly at the time of an examination; or it may produce symptoms and then be discovered during the investigation of the cause of such symptoms.

The majority of these neoplasms occur 5 to 8 cm. from the anorectal line, but a few have been found from 1 to 12 cm. from this line.[9,29] The primary tumor is usually small and single, and generally measures between 0.5 and 1.0 cm. in diameter. However, small multiple tumors have been described, as in the case of Rigdon, in which the entire rectum was covered with small nodules.[25] These neoplasms are yellow, orange or red in color, submucosal in location and may be freely moveable or fixed to the rectal wall. Occasionally, however, large, infiltrating, annular, fixed, ulcerating masses are described, as in the case of Pearson and Fitzgerald.[20] In these large tumors the overlying mucosa is likely to be no longer intact. Sex and race are not factors; carcinoids occur almost equally in men and women. There is an almost equal incidence in Caucasians and Negroes.[29] In Epp's review of seventy-two rectal carcinoids there was no variation in incidence from the third decade through the seventh decade; however, some authors state that the majority of these tumors occur after forty years of age.[5,9,29] In Epp's review eighteen tumors were found on the anterior rectal wall, three were on the posterior rectal wall and three were constricting in nature. Two were on the lateral rectal wall, and in forty-six the location was not given. Duration of symptoms varied from several weeks to several months.[9] Metastases were proved in eight of these seventy-two cases.[9] Since this report, Foreman, and Tavenner et al. have each reported a case with metastases.[11,29] Kunkel et al. found thirteen cases of rectal carcinoids with metastases reported in the literature. They added another.[16] The principal sites for metastases are the regional nodes and liver; however, metastatic disease has been found in the lungs, vertebrae, kidneys, ureters, broad ligaments, spleen, heart, pancreas, ovaries and adrenals.[9,11,20,21]

As reports of rectal carcinoids accumulate, it has become apparent that these tumors are clinically either benign or extremely malignant. Kunkel, in his review of the subject, was able to collect fourteen cases of malignant rectal carcinoid from the literature.[7] In these cases metastases were usually far advanced when the patient was first seen. This is in contrast to metastases from small bowel carcinoids which may remain dormant for years. It has been estimated that one-third of the patients with known metastases from small bowel carcinoids live eight years or longer. Of ten malignant rectal cases, symptoms were referred to the primary tumor in eight cases and to hepatic insufficiency from metastases in two cases.

The malignant nature of some rectal carcinoids has led Rosser to suggest that there may be two distinct varieties of these tumors, namely (1) a benign lesion which may infiltrate all the layers of the intestine, but is apparently halted at the serosa, and (2) a type of tumor exhibiting from the beginning a highly malignant tendency.[26] Rectal carcinoids are often referred to as being either "benign" or "malignant"; however, Dukes and others believe that there is no histologic difference between the two.[8] Some authors believe that in all carcinoids the microscopic appearance is that of carcinoma simplex and whether "benign" or "malignant," the cellular features are constant. Therefore, it is not possible to distinguish between the two types on a histologic basis alone.

It is generally believed that these tumors are definitely malignant, but as a rule, slow-growing and slow to metastasize. Many authorities consider them to be "Carcinoma, Grade 1 (Broder)."[9,11,21] Raven studied this problem and concluded that "the formation of metastases is only a matter of time, although the degree of malignancy is less than in adenocarcinoma. As the tumor enlarges, the cells will eventually transgress their barriers."[23] Although all of these tumors should be considered as being malignant, it is probably safe to assume that there is a considerable variation in the degree of malignant potential from one tumor to the next. Foreman believes "all carcinoid tumors are potentially malignant and all will become manifestly malignant if permitted to fulfill their natural courses."[11] Thus, the consensus of authoritative opinion seems to indicate that all of these tumors are malignant.

As previously stated, the majority of rectal carcinoids are asymptomatic; however, bleeding, tenesmus, diarrhea, back pain, constipation, emesis, weight loss and large bowel obstruction have been described. It would seem that the malignant lesions are much more apt to manifest themselves by the aforementioned symptoms than are the benign lesions which tend to be asymptomatic or at least associated with minimal symptomatology.

According to Tavenner et al., Ritchie and Stafford reported 332 cases of carcinoids of the gastrointestinal tract. Of these, 37.9 per cent showed evidence of metastases.[29] Of the 111 rectal carcinoids reported in the literature, only fourteen have shown metastases, an incidence of 12.6 per cent. Except for carcinoid tumors of the appendix, rectal carcinoids exhibit the lowest incidence of metastases.

The pathology of rectal carcinoids has been thoroughly studied and adequately described elsewhere and a discussion of this feature will not be included here.[1,2,5,21,30]

Treatment. There is no universal agreement as to the proper treatment of rectal carcinoids. The subject has been discussed at length in the recent literature and there seems to be considerable divergence of opinion as to the proper therapy in any given case. It appears that the ultimate decision must be based on knowledge which we do not yet possess.

Most writers have advised conservative treatment of these tumors.[4,8,9,15,31] The reported experience of Epps, Cohen, Freund, Stout, Helwig and Dukes would seem to obviate radical surgery if no metastases can be found and if the local lesions are not too large to remove easily. The problem of therapy has been considered by Shepard, Strug and Di Leo.[11] Their conclusion was that single nodules 1 cm. or less in diameter might be locally removed, followed by thorough microscopic evaluation of the specimen to be certain of complete removal. If the tumor had invaded the serosa or if microscopic examination revealed incomplete removal, radical resection of the rectum was recommended. They suggested combined resection of the rectum for all tumors over 1 cm. in diameter, all ulcerating or infiltrating tumors, and all tumors having multiple sites of origin.

The following is taken from Foreman's

report, and appears to represent a rational and logical approach to the problem: "1. Local excision is proper for small tumors in cases where there is no evidence of malignancy, such as fixation of the tumor, enlarged liver, intestinal obstruction or symptoms of hepatic insufficiency. A generous margin of grossly normal tissue should be excised with the tumor, and the specimen should be carefully examined to be sure of complete removal. Ulcerated tumors should be studied with special care. If this examination reveals infiltration of tumor cells through the serosa into the peri-rectal tissues, or infiltration along the submucosa beyond the margins of the specimen, or tumor emboli in the lymphatic vessels the entire rectum should be resected subsequently. In cases where local excision has been the only method of treatment, the patient probably ought to be re-examined regularly for evidence of recurrence, although no instance has ever been reported. 2. Combined abdominoperineal resection of the rectum is the treatment of choice in the following categories: (a) Large tumors. Two centimeters is tentatively suggested as the critical diameter. This would include all tumors which cannot be locally excised with an adequate margin of normal tissue without compromising the rectum. (b) Annular constricting lesions. (c) Tumors fixed to the peri-rectal tissues. (d) Recurrent tumors. (e) All obviously malignant tumors, except those in group 3. 3. The course of most patients with malignant rectal carcinoids has been rapidly fatal. In view of this, palliation alone would seem to be indicated for cases with widespread metastases, as demonstrated by enlarged liver or symptoms of hepatic insufficiency. In contrast to the experience with small intestinal carcinoids, widespread metastases from a rectal carcinoid is not compatible with long existence."[11]

X-ray therapy should be mentioned for the sake of completeness. Ariel suggested that radiation might be effective. He reported one case of carcinoid of the small bowel, initially treated by surgical excision. The patient returned two months later with a mass at the operative site. The mass was thought, but not proved, to be a local recurrence. An unspecified dose of radiation was administered. The mass disappeared after this therapy. The patient was alive and well thirty months later. Ariel suggested, on the basis of this case, that carcinoids may be radiosensitive. Since some patients have lived for years with stationary metastases, it is difficult to evaluate a response of this type.

CASE REPORTS

CASE 1. This patient, a thirty-two year old white man, was admitted to Letterman Army Hospital on December 15, 1950. For the previous eight years he had experienced intermittently the passage of small quantities of bright red blood at the time of defecation. In 1942 he was told he had external hemorrhoids. The patient believed that the passage of blood with bowel movements was based on the hemorrhoids. In 1948 and again in 1950 he experienced profuse bleeding from the rectum. Each of these episodes persisted for three to four weeks and abated without examination or treatment.

In November, 1950, he noted rather persistent, cramping right lower quadrant abdominal pain. This was associated with the onset of rather severe bloody diarrhea and urinary urgency with frequency. There had been a 20 pound weight loss during the previous two to three months. He was evaluated briefly at another hospital where a mass was found in the rectum. He was then transferred to this hospital.

Examination here revealed a large, hard, fixed, 5 by 7 cm., slightly lobular, submucosal mass on the right lateral rectal wall. The lower level of this mass was 6 cm. above the anorectal line. The rectal lumen was markedly compromised. The overlying mucosa was friable, ulcerated and bled easily on contact. A biopsy specimen of the mass was reported as "invasive anaplastic carcinoma of the rectum." Chest x-ray and long bone survey revealed no abnormalities. Intravenous urograms were normal. Cystoscopy revealed a mild, generalized trabeculation of the bladder and an elevation of the bladder floor suggesting pressure from an extrinsic mass.

On December 29, 1950, combined abdominoperineal resection was performed. During the abdominal portion of this procedure, no evidence of metastases could be found. The postoperative course was complicated by an incomplete, small bowel intestinal obstruction, as well as a partial dehiscence of the abdominal wound. Further surgery was required for this on January 5, 1951.

The patient convalesced satisfactorily from

this point on and was soon discharged from the hospital.

Histologic evaluation of the tissue removed at the time of surgery revealed that the initial diagnosis of invasive adenocarcinoma of the rectum was incorrect. A diagnosis of "carcinoid of the rectum, invasive" was made. This diagnosis was substantiated by the Armed Forces Institute of Pathology.

Since discharge from the hospital this patient has been thoroughly re-evaluated at six-month intervals. To date, he has shown no evidence of recurrence or metastases. His appetite is excellent, his current weight is 205 pounds, the colostomy functions well and he maintains a full time job. His only complaint is sexual impotence, a result of the operative procedure.

Comment. This case is quite interesting from several standpoints. The patient had experienced rectal bleeding with defecation for some eight years prior to the onset of symptoms suggestive of an irritating obstructive rectal mass. The initial clinical impression was adenocarcinoma of the rectum, seemingly substantiated by the histologic evaluation of the tissue removed at biopsy. Combined resection of the rectum was performed under the erroneous impression that the tumor was an adenocarcinoma. Nevertheless, this treatment was unquestionably correct as evidenced by the patient's long survival thus far. Foreman cites four other similar cases in the literature in which the initial diagnosis was adenocarcinoma, combined resection of the rectum was carried out, and the neoplasm was ultimately diagnosed as a carcinoid.

In view of this patient's history of melena, anorexia, weight loss, diarrhea and bladder symptoms, coupled with his physical findings and initial pathologic diagnosis, one would strongly suspect that this neoplasm would be of the malignant type. However, at the time of surgery and on subsequent rechecks no evidence of recurrence has been discovered.

Case II. This patient, a twenty-one year old white soldier, was admitted to another nearby hospital on August 17, 1952, with signs and symptoms of acute appendicitis. During the course of the physical examination a rectal mass was palpated. Appendectomy was performed and an enlarged, inflamed appendix with a terminal perforation was removed. Further examination at the time of this procedure revealed a large mass, measuring 5 cm., deep in the pelvis attached to the left pelvic wall. Several large firm nodes were palpated low in the mesentery of the sigmoid colon. The postoperative course was uneventful.

On August 29, 1952, the rectal mass was examined histologically. The tissue removed was submitted to the Armed Forces Institute of Pathology and a diagnosis of "malignant tumor, possible malignant carcinoid" was returned.

The patient had been completely asymptomatic. There was no history of weight loss, anorexia, melena, diarrhea, malaise, bladder disturbances, painful defecation or alteration in bowel habit.

The patient was transferred to this hospital in September, 1952. Physical examination revealed a 2 by 8 cm., firm, rubbery, irregular, partially fixed, submucosal mass on the left lateral rectal wall. Its lower edge was 3 cm. above the anorectal line. Proctoscopy revealed slight ulceration of the mucosa over this mass, with slight bleeding on contact. Roentgenograms of the chest, pelvis, long bones and spine showed no abnormalities. Routine blood and urine studies were normal. An upper gastrointestinal barium study showed no defects. Barium enema revealed a filling defect in the rectum. Cystoscopy showed elevation of the bladder floor from an extrinsic mass. Retrograde pyelography revealed a partial obstruction of the lower third of the left ureter, with a proximal dilatation. On October 6, 1952, the rectal mass was examined histologically for the second time. This was reported as "carcinoid of the rectum."

It was decided to attempt an abdominoperineal resection. On November 18th abdominal exploration revealed marked involvement of the left lateral pelvic wall by numerous, firm, rubbery, tumor nodules. These nodules varied in diameter from 0.5 to 3.0 cm. Extensive involvement of the pelvic gutter on the left was present. The base of the bladder on the left was retracted and markedly involved by neoplasm. A large, hard, irregular mass was palpated low in the pelvis on the left, extending down into the rectum. Several enlarged, hard, lymph nodes were palpated in the mesentery of the sigmoid colon. One of these nodes was obtained for "frozen section," and was reported to be malignant. No other metastases were noted. Because of the extensive involvement of the pelvic structures, curative surgery was

not believed to be feasible. In view of the fact that the patient was asymptomatic, it was believed that palliative surgery was not indicated at the time. The postoperative course was uneventful. Pathologic diagnosis of the lymph node removed at the time of surgery was "carcinoid."

Since no definitive procedure was feasible at surgery, it was elected to subject the patient to a course of irradiation therapy. Accordingly, a tumor dose of 3,550 r was administered over a period of forty-one days through two opposing 20 by 20 cm. fields covering the pelvis and lower abdomen. At the completion of this therapy he remained asymptomatic; however, there had been no change in the rectal mass. Two months after the completion of x-ray therapy the mass in the rectum was examined histologically. No evidence of irradiation effect was revealed. The patient was followed up for twenty-two months after surgery and irradiation and was last seen on June 12, 1954, at which time there was no apparent change in condition. He remained asymptomatic and there was no appreciable change in the size of the rectal mass as compared to pretreatment evaluation.

Comment. To my knowledge, this is the only case of so-called "malignant" rectal carcinoid that has been diagnosed prior to the onset of symptoms. As stated, this tumor was discovered, incidentally, at the time of physical examination for another disease. In spite of the absence of symptoms, metastases were noted at the time of surgery.

The decision to treat this neoplasm with irradiation was not prompted by previous successful results of others. In Ariel's single case there is no certainty that the mass treated was a recurrence of the tumor. Reports of irradiation of this tumor are meager. It appears that irradiation produced no beneficial response in this case. It is possible that palliative surgery will be indicated in the future.

Case III. This patient, a forty-two year old white man, was hospitalized at Letterman Army Hospital in May, 1950, because of an eight-year history of periumbilical and left lower quadrant abdominal pain following meals. This was associated with the passage of four to five loose watery stools daily, containing no blood, pus or mucus. Examination of stools revealed the presence of Endamoeba coli, Endamoeba histolytica, Endolimax nana and Giardia lamblia. Barium enema revealed no abnormalities and anoscopic examination was normal. Sigmoidoscopy revealed the presence of a small polyp located at 9 cm. on the left lateral rectal wall. This polyp was examined histologically. It was an adenomatous polyp associated with a carcinoid. It was believed to have been completely excised. The patient has been lost to follow-up examination.

Case IV. This patient, a sixty-five year old white man, was first seen on April 18, 1953, because of a persistent sensation of rectal fullness associated with an urge to defecate. This had been present for approximately eight to ten months. There had been no change in bowel habit, and no pain or blood with defecation. One year previously he had undergone suprapubic prostatectomy for benign prostatic hypertrophy. There had been no weight loss.

Examination revealed a firm, rubbery, nonmobile, non-tender, submucosal nodule, measuring 1 by 1.5 cm., located at the posterior midline, 8 cm. from the anal verge. Barium enema revealed only diverticulosis. The mass was excised locally and reported as being a carcinoid. Two weeks later several biopsy specimens were taken about the periphery of the incision and showed no evidence of tumor.

The patient was last seen on February 9, 1954, at which time there was no evidence of local recurrence of the rectal carcinoid. Barium enema again showed only diverticulosis.

Case V. This patient, a forty-nine year old white woman, was first seen at Letterman Army Hospital on July 31, 1953, having been referred from an outside source with a diagnosis of adenocarcinoma of the rectum. History indicated that she began to feel badly in general in October, 1952. This was associated with the onset of two to three soft bowel movements daily; this had increased to four to five movements a day when first seen at Letterman Army Hospital. She was under constant care of a physician, being seen weekly for almost a year, without improvement. Approximately one month prior to being seen here, she changed physicians. The second physician noted a tender anterior rectal mass, measuring approximately 1 by 2 cm., located 4 cm. from the anal verge. This was examined histologically on July 14, 1953, the report being adenocarcinoma of rectum. The patient was then referred to Letterman Army Hospital. There had been no weight loss or rectal bleeding;

however, there had been some local discomfort with defecation.

Review of the pathology sections at this hospital and also at the Armed Forces Institute of Pathology indicated that the lesion was a carcinoid and not adenocarcinoma. Barium enema revealed diverticulosis only. Chest x-ray was normal. Complete blood count and serology were normal. Urinalysis revealed a 2 plus albuminuria.

The remainder of the lesion was removed locally and some two weeks later the edges about the periphery of the excision site were examined histologically. These biopsy specimens revealed no evidence of tumor.

CASE VI. This patient, a twenty-nine year old white man, was seen at Letterman Army Hospital in July, 1950, with a complaint of vague, intermittent, lower abdominal distress of two years' duration. There was no history of anorexia, weight loss, diarrhea, pain or blood with defecation. Examination revealed what was felt to be a small, sessile polyp located 6 cm. from the anorectal line in the posterior midline. This was excised locally and reported to be carcinoid.

He was last seen in February, 1952, at which time there was no evidence of recurrence.

SUMMARY

The literature pertaining to carcinoid tumors has been reviewed, and emphasis has been placed on those tumors which occur in the rectum. A brief historical review of these neoplasms is given, the incidence and clinical manifestations are discussed, and a logical approach to the problem of therapy is presented. Six cases of rectal carcinoids have been presented, one of which was a "malignant" neoplasm.

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Review of Some Experiments with Freeze-dried Grafts

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FREEZE-DRYING as a method of preserving tissue for grafting is better in some respects and is definitely inferior in others to alternate methods of preservation. Tissue to be freeze-dried is removed from the donor shortly after death either at sterile autopsy or at ordinary autopsy, and later sterilized with chemicals such as ethylene oxide[2] or cathode irradiation.[3,8,18] The tissue is frozen by partial immersion of its container in a mixture of dry ice and alcohol, and the free water is removed directly from the frozen state in a vacuum. The tissue is then sealed in vacuum in small containers and may be stored at room temperature for periods of at least two years without detectable change. Although processing is somewhat complicated and expensive, the ease of storing, shipping and stockpiling is a practical advantage of this technic.[4,7]

Freeze-dried grafts cannot be used to replace tissues which must carry on active metabolism in order to function properly. However, they will often serve admirably as replacements for tissues which must perform only mechanical function.

The freeze-drying process destroys the viability of all tissue cells. However, if proper specifications are followed, the mechanical properties of the extracellular materials such as collagen and elastic fibers are not significantly altered.[9] Muscle cells, where present, degenerate very rapidly, collagen fibers persist for several months and elastic fibers often suffer little destruction after years in the recipient. Invading fibroblasts from the host replace the degenerated cells of the original graft and lay down new collagen. In general, if the replacement occurs well before the materials of the original graft wear out, the graft will be successful.[9,10]

An important factor in the ultimate result obtained with a graft is the amount of adverse host tissue reaction evoked. This may be related to antigenic constituents in the grafts. Preliminary immunologic studies were done with arteries in a heterograft system. Aqueous extracts were made of fresh, and also of freeze-dried dog artery, and injected into rabbits. Precipitin tests suggested that soluble antigenic material was removed from the freeze-dried vessels by reconstitution and washing.[13] There is no proof that this alteration of antigenicity demonstrated in the heterograft system is related to the host tissue reaction in the homograft system.

A series of animal experiments has indicated that freeze-dried grafts adequately perform mechanical functions in many sites in the body and that they stimulate less fibroblastic reaction by the host than comparable fresh homologous tissue. They are incapable of contributing to the fibroblastic reaction and in some locations may produce less fibrosis than autogenous tissue.

EXPERIENCE WITH SPECIFIC TISSUES

Arterial Grafts

Freeze-dried homologous arteries which were removed at sterile autopsy were placed in the abdominal aorta of forty-eight dogs; comparable fresh homografts were placed in twenty-two dogs. These animals were followed up from 1 to 104 weeks.[10] Although the incidence of failure was low in both series, there

was less mural thrombus and less destruction of elastic fibers in the freeze-dried grafts.

Further evidence of the decreased host tissue reaction to the freeze-dried homografts was observed in elasticity studies.[12] The fresh grafts showed a progressive loss of elasticity until stabilization occurred after about six months' implantation in dogs. This change was well correlated with the fibrosis seen around the grafts by microscopic examination. Although the freeze-dried grafts suffered a more rapid initial loss of elasticity, they stabilized sooner and nearer the normal level.

Segments of aorta taken from young pigs were freeze-dried and placed in the abdominal aorta of thirty-one dogs.[13] Here the results were far inferior to those obtained with freeze-dried homografts but were much better by gross and microscopic evaluation than those of the same type of vessel used as fresh heterografts. This difference is believed to have been due largely to a decrease in the host tissue reaction.

Fascial Grafts

Freeze-dried homologous fascia from the anterior rectus sheath was used to replace large defects in the diaphragms of ten dogs.[16] Many of these dogs were explored after one month and the grafts were found to be intact. However, nearly all of them showed severe thinning which resulted in large diaphragmatic hernias when they were sacrificed four months later.

The same type of fascial grafts was used to repair large ventral hernias surgically created in the abdominal wall of dogs by removing the fascia, muscle and peritoneum. Some of these animals have been followed up for twelve months without any sign of weakening of the repair or recurrence of the hernia.

These experiments with fascia illustrate a basic principle in the use of freeze-dried tissue. The rate of replacement by host fibroblasts is not more than about 1 mm. per month. Therefore, at least one surface of the graft should be in contact with host tissue from which replacement can occur. Fibroblasts from the subcutaneous tissue invaded the fascial grafts used to repair the ventral hernias, but effective replacement could occur only at the edges of the fascia in the diaphragm. In this latter site there was little opportunity for replacement before the original graft material wore out and failure occurred.

Tendon Sheath Replacements

Freeze-dried arteries have been used in twenty-four dogs to form sheaths around injured tendons.[5] As controls, tendons were traumatized, partially divided and resutured, and the legs immobilized. Adhesions which formed between these tendons and surrounding structures were demonstrated at a second operation. These adhesions were then divided and freeze-dried homologous arteries were used as sheaths around the injured portions of the tendons. Host fibroblasts grew from the surrounding tissues into sheath. However, even with immobilization there was little tendency for fibroblastic connection to occur between the tendon and the adjacent intimal surface of the freeze-dried artery.

Dura Mater Grafts

A similar phenomenon was observed in the experiments on freeze-dried dura.[15] In these dogs, fibroblasts grew from the overlying traumatized temporal muscle into the dura and nearly replaced it but did not continue through to the opposite side of the graft. There was no formation of adhesions to the brain.

Bone Grafts

Freeze-dried homologous bone was implanted in dogs.[6,19] These grafts, which were eventually replaced by the host with healthy bone, performed their mechanical function well until this replacement occurred. There was little evidence of unfavorable reaction. The rate of healing was slower than that obtained with autogenous bone but seemed about the same as that of the frozen homologous grafts. Freeze-dried bone has been used at the Naval Medical Center in over 150 human cases, and an additional 200 grafts from the Naval Medical School Tissue Bank have been used by collaborating surgeons. The clinical results are satisfactory.[1]

Visceral Replacements

Attempts have been made to use segments of freeze-dried tissue to replace visceral tubes. Freeze-dried homologous esophagus was used to replace the major portion of the thoracic esophagus.[11] These grafts failed because of

degeneration and rupture. This failure emphasizes the fact that a structure composed largely of muscle fibers cannot be expected to function satisfactorily after freeze-drying. Freeze-dried calf thoracic aorta was used for the same purpose, and again failure resulted.[16] While homologous aorta might be expected to work better than heterologous, the result probably would have been the same. Microscopic study showed severe fibroblastic reaction and many polymorphonuclear leukocytes.

Segments of freeze-dried homologous artery were used to replace the common duct[14] and also to replace sections of the ureter.[17] Whereas most of the dogs in both series lived for several months, the experiments failed because of disintegration of the graft material, with fibrosis and stricture of the ducts. These experiments showed that freeze-dried arterial grafts did not function successfully as visceral tubes.

Skin Grafts

Comparable fresh and freeze-dried split-thickness homologous skin grafts were implanted in surgically created full-thickness skin defects on dogs and rabbits. Both types of grafts survived an average time of approximately two weeks in each species.

Microscopic observations demonstrated slightly deeper fibrosis in the beds of the fresh grafts on dogs. This reaction in general increased as the time of graft survival progressed. In the histologic picture of the beds after sloughing of the grafts there were unevenly distributed masses of polymorphonuclear leukocytes and giant cells, which were especially prominent around fragments of hair.

The wounds of the rabbits showed striking contraction but insignificant residual fibrosis after sloughing of the grafts.

SUMMARY

In our experience the process of preserving homologous tissue by freeze-drying for subsequent grafting has certain practical advantages. However, it also has important limitations. Freeze-dried grafts of some types of tissue result in less host tissue reaction than is seen with comparable fresh grafts. The cells are dead and the process is useful only when mechanical function and not metabolic activity is required of the grafted tissue. The grafts, in general, were successful when they were implanted in an area where they could be replaced readily by host fibroblasts and in regions free from bacterial contamination and irritating chemicals. When these criteria were met, the freeze-dried grafts were successful in animals.

Successful results were obtained with arteries used for arterial replacement and as tendon sheaths. Freeze-dried bone, and also dura, functioned satisfactorily as replacements for their respective tissues. Fascia was satisfactory for the repair of ventral hernias. Preserved esophagus and artery failed when used as esophagus. Arteries failed in common bile ducts and in ureters. Fascia failed in the diaphragm. Freeze-dried homologous skin sloughed at approximately the same time as viable homologous skin.

Acknowledgment: The authors wish to acknowledge the operating room management and technical assistance of the following men during the experiments included in this review: R. M. Barber, HM3; T. Buchanan, HM3; W. E. Dunham, HM3; R. L. Replogle, HM2; S. T. Scott, HM2; C. J. Waido, HM3; and H. E. Warford, HM3. The histologic work was done by J. G. Griffin, HMC; and K. G. Gibbons, HM3. Students from the Tissue Bank School of the Naval Medical School assisted during the operations.

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Bone Growth Following Partial Resection of the Epiphyseal Cartilage

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Read at the American College of Surgeon's Forum on Fundamental Surgical Problems, Atlantic City, New Jersey, November 17, 1954. This work was supported by the Committee on the Advancement of Research, University of Pennsylvania, and the Harrison Department of Surgical Research, University of Pennsylvania, Philadelphia, Pennsylvania.

FOLLOWING injury to a growing epiphysis, distorted or arrested growth is frequently noted. The factors involved which permit normal growth to continue after some extensive injuries, but which cause cessation of growth or abnormal growth after a seemingly trivial injury, are not well understood.

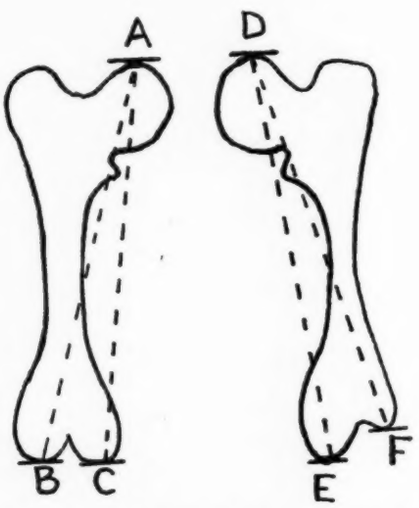

FIG. 1. The valgus factor was determined by measuring the distance between the head and each of the condyles and subtracting the figure on the control side from the operative side. DE − DF = X (valgus on operated side). AC − AB = Y (valgus on control side). X − Y = valgus factor.

Langenskiöld and Edgren have cast some light on the growth of epiphyseal cartilage after injury. After selective radiation of part of an epiphysis these authors showed that the destroyed area is displaced by an ingrowth of cartilage columns from undamaged areas which have migrated into the areas of destroyed cartilage. Lateral irradiated areas were forced peripherally, and if not too large were eliminated, leaving a notched defect in the metaphysis and some valgus or varus, the epiphyseal plate regaining its normal transverse diameter. If the irradiated areas were in the central portion of the plate, growing cartilage cells from its intact borders grew into the defect and no deformity in growth resulted.

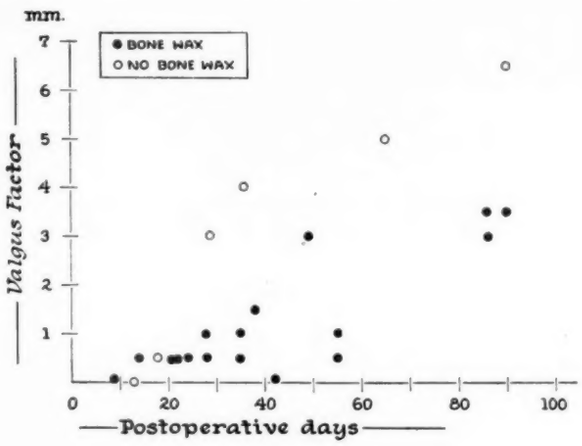

FIG. 2.

Lacroix described experiments in which the entire epiphysis was subjected to heavy radiation; this was followed by disorganization of the cartilage and subsequent regeneration from areas that had been spared. Selye amputated the hind limbs of twelve to fifteen day old rats at a level just proximal to the lower femoral epiphysis and noted that the cartilage plate reappeared several weeks later.

In this study the epiphyseal cartilage subserving the lateral femoral condyle of six week old rabbits was surgically resected and the defect plugged with bone wax in an effort

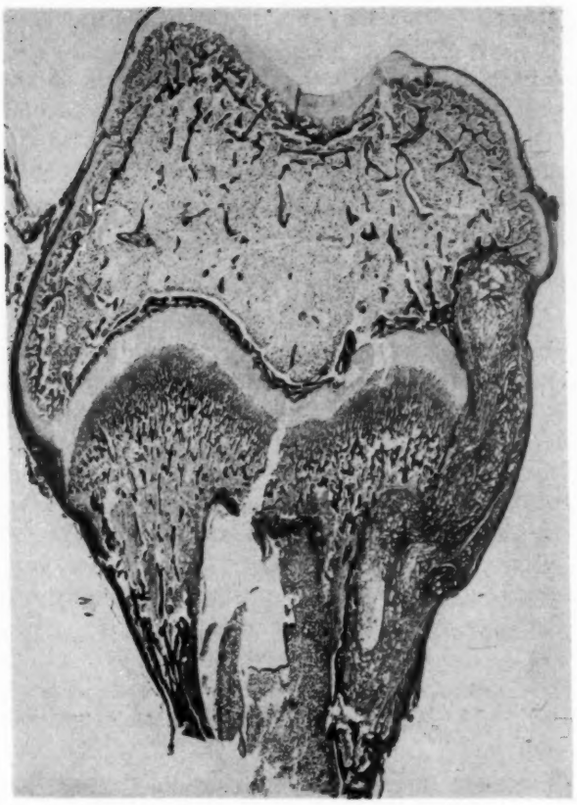

FIG. 3. Resection of lateral portion of epiphyseal line and packing of defect with bone wax; twenty-one days postoperatively. The pattern of growth sequences extends unchanged to the area of resection.

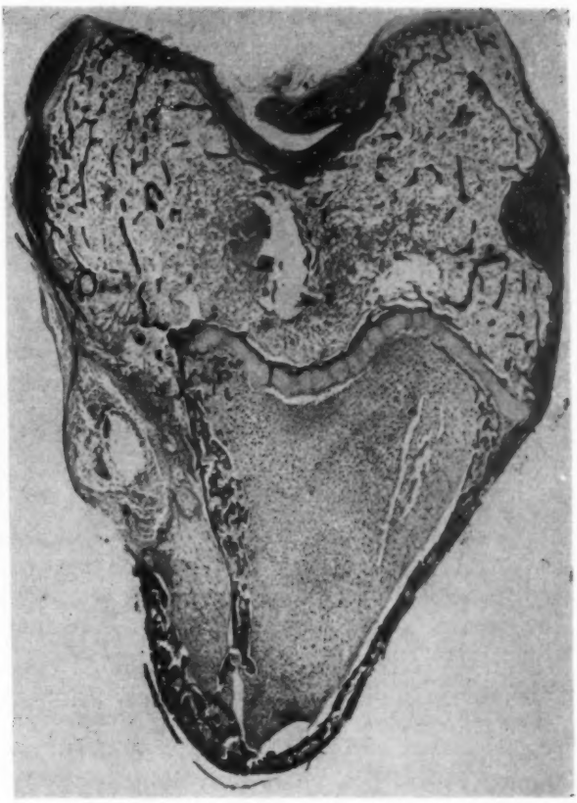

FIG. 4. Resection of lateral portion of epiphyseal line with bone wax inserted into defect; fifty-five days postoperatively. Animal has reached full growth and epiphyseal line is inactive on the operative and nonoperative side. Bone trabeculae are seen uniting epiphysis to metaphysis but the lateral condyle is almost as fully developed as the medial. A new inwardly displaced cortex is seen.

to prevent the development of epiphyseal fusion. The medial half of the growth line was undisturbed. Measurements were made to determine the degree of valgus and shortening which developed, and histologic sections were studied to note whether any regeneration occurred and the response of the remaining epiphyseal line to such an injury. Controls used were the opposite femur and other animals in which the epiphyseal line was resected but not packed with wax. Roentgenograms of the dissected specimens were also employed to study the characteristics of the line. Twenty-three animals were studied, having been sacrificed at intervals up to ninety days.

Shortening was ascertained by measurement with calipers on the dissected femur, the determination being made between the head and distal medial condyle of the operated and control side. The amount of valgus development was reduced to a figure expressed in millimeters by measuring the distance between the head and each of the condyles on the operated and control sides. The difference between the head to lateral condyle and head to medial condyle distance on the control side from a similar figure on the operated side constituted the valgus factor. (Fig. 1.)

Figure 2 indicates that in almost all of the animals some valgus deformity developed which increased as the postoperative time increased. It also indicates that less deformity developed in those animals in which bone wax was packed into the defect in an effort to prevent fusion between the metaphysis and epiphysis than in those in which no effort was made to prevent such an occurrence. Those animals with marked valgus showed the greatest shortening.

Roentgenograms of the dissected femurs were taken to note the extent of the epiphyseal line laterally and whether it was crossed by

bone trabeculae. Of eighteen animals sacrificed more than fifteen days postoperatively, the epiphyseal line showed no trabeculae uniting the metaphysis to the epiphysis in nine. Eight of these were packed with bone wax. In none of the animals did films show a restoration of the transverse diameter of the bone at the site of resection, although in several there was an elongation of the defect suggesting continued growth from the residual epiphyseal line.

Each specimen was sectioned in the plane of the longitudinal axis of the femur and several hundred sections were studied. No definite evidence of regeneration of the resected portion of the epiphyseal line was observed. Islands of cartilage showing bone-forming sequence were frequently seen in the metaphysis adjacent to the bone wax deposit, but whether these represented new cartilage nests or displaced cartilage could not be ascertained. The medial and central portions of the line adjacent to the resected segment showed no histologic alteration. (Fig. 3.)

In many of the older animals in which bone wax was used the lateral metaphyseal cortex was inwardly displaced and the transverse diameter of the newly formed bone was narrowed corresponding to the reduced epiphyseal line. The notching defect described by Langenskiöld which depends on restitution of the epiphyseal line to its former diameter was not observed. (Fig. 4.)

New trabeculae from the subchondral bone adjacent to the epiphyseal line grew proximally into the surgical defect in almost all of the animals. In some specimens these trabeculae seemed to be prevented from uniting with the metaphysis by the interposed wax. This may explain why such animals developed less valgus than those in which wax was not used.

CONCLUSIONS

Following resection of the lateral epiphyseal line of the distal femoral epiphysis in rabbits, a new line failed to develop and no evidence of cartilage regeneration could be definitely noted.

The use of bone wax to prevent valgus formation was partially successful and a more satisfactory interposition material might be found which could prevent growth distortions following destruction of part of the epiphyseal line.

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A Comparison of Healing in the Deep and Superficial Layers of Experimental Abdominal Incisions

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A REASONABLE survey of the literature reveals no reports on the relative properties of various elements of abdominal incisions to heal, e.g., the comparative ability of muscle, fascia, peritoneum and skin layers of an incision to unite. This is significant for several reasons: (1) to understand more clearly the role of healing capability of these tissues in the cause and manner of abdominal wound disruption and wound hernia; (2) to establish a normal pattern of healing in a standardized abdominal incision, so that experiments designed to determine the effects of various drugs on this healing incision may be performed.

A few reports[1–3] have dealt directly or indirectly with the respective healing ability of tissues. These reports have, however, either not concerned themselves with an abdominal incision, or have utilized non-absorbable suture in the approximation of the wound without removal of sutures prior to wound testing.

The present study has had for its purpose comparison of the relative healing properties of the deep (muscle, fascia and peritoneum) layers of experimental abdominal incisions in rats with the superficial (skin and subcutaneous tissue) layer in this animal.

PLANS OF STUDY

Two plans of investigation were pursued. The first plan consisted of experimental abdominal wound dehiscence at respective postoperative periods in rats. The second included histologic examination of the disrupted wounds and of intact healing incisions of the abdominal wall in these animals.

The wound disruption technic was essentially a modification of a method previously reported,[4] in which pressure within the abdomen was gradually elevated through an intra-abdominally placed thin rubber balloon attached to an external pumping system and aneroid. In this study, however, to effect the higher testing pressures necessary for disrupting wounds in the advanced stages of healing, the pelvis of the animal was sealed off from the general peritoneal cavity by a tight ligature about the lower abdomen. This prevented annoying disruptions of the pelvic peritoneum at moderate pressures.

A left paramedian incision of approximately 1.5 cm. in length was made for the test and was closed with three through and through steel wire sutures. The strength of the incision was determined on the second, fifth and ninth postoperative days following suture removal. These periods were decided upon because they represented, respectively, a period of healing prior to the onset of active wound fibroplasia, a period at the onset of fibroplasia, and finally, a period well into the active fibroplastic stage.

With the elevation of pressures within the abdomen it was possible to note the three following different disruption patterns: (1) dehiscence of the underlying peritoneum, muscle and fascia denoted by a sudden bulging upward of the skin; (2) disruption of the skin alone which was readily seen; and (3) total disruption of the wound followed by protrusion of the rubber balloon through the wound. The pressures at which these particular types of disruption occurred were recorded.

Seven rats were utilized on each test day. These animals were Sprague-Dawley strain, 350 plus or minus 25 gm. weight, and were maintained on a purina chow ad libitum diet. Nembutal was utilized for initial anesthetization and the animals were sacrificed with ether. Histologic material was taken from the disrupted specimens and was both individually

studied and correlated with previously obtained, intact abdominal incision material derived from fifteen normal rats. Hematoxylin and eosin, Mallory trichrome, van Gieson and silver stains were utilized in the process of this histologic study.

TABLE 1
COMPARISON OF BURSTING STRENGTH OF SUPERFICIAL LAYER AND DEEP LAYER OF HEALING ABDOMINAL WALL INCISIONS IN RATS

Postoperative Day	Skin Disruption (mm. Hg.)	Muscle, Fascia, Peritoneum Disruption (mm. Hg.)	Mean Difference Skin–Muscle, Fascia, Peritoneum (mm. Hg.)
Second	96	34	62
	84	40	44
	80	60	20
	80	60	20
	76	54	22
	84	35	49
	90	44	46
Mean:	84.3 (84)	46.7 (47)	37.6 (38)
Fifth	100	100	0
	106	106	0
	128	90	38
	118	100	18
	120	102	18
	98	92	6
	94	84	10
Mean:	109	96.3 (96)	12.8 (13)
Ninth	235	244	−9
	161	135	26
	140	140	0
	208	190	18
	182	178	4
	222	218	4
	204	204	0
Mean:	193.1 (193)	187	6.1 (6)

RESULTS

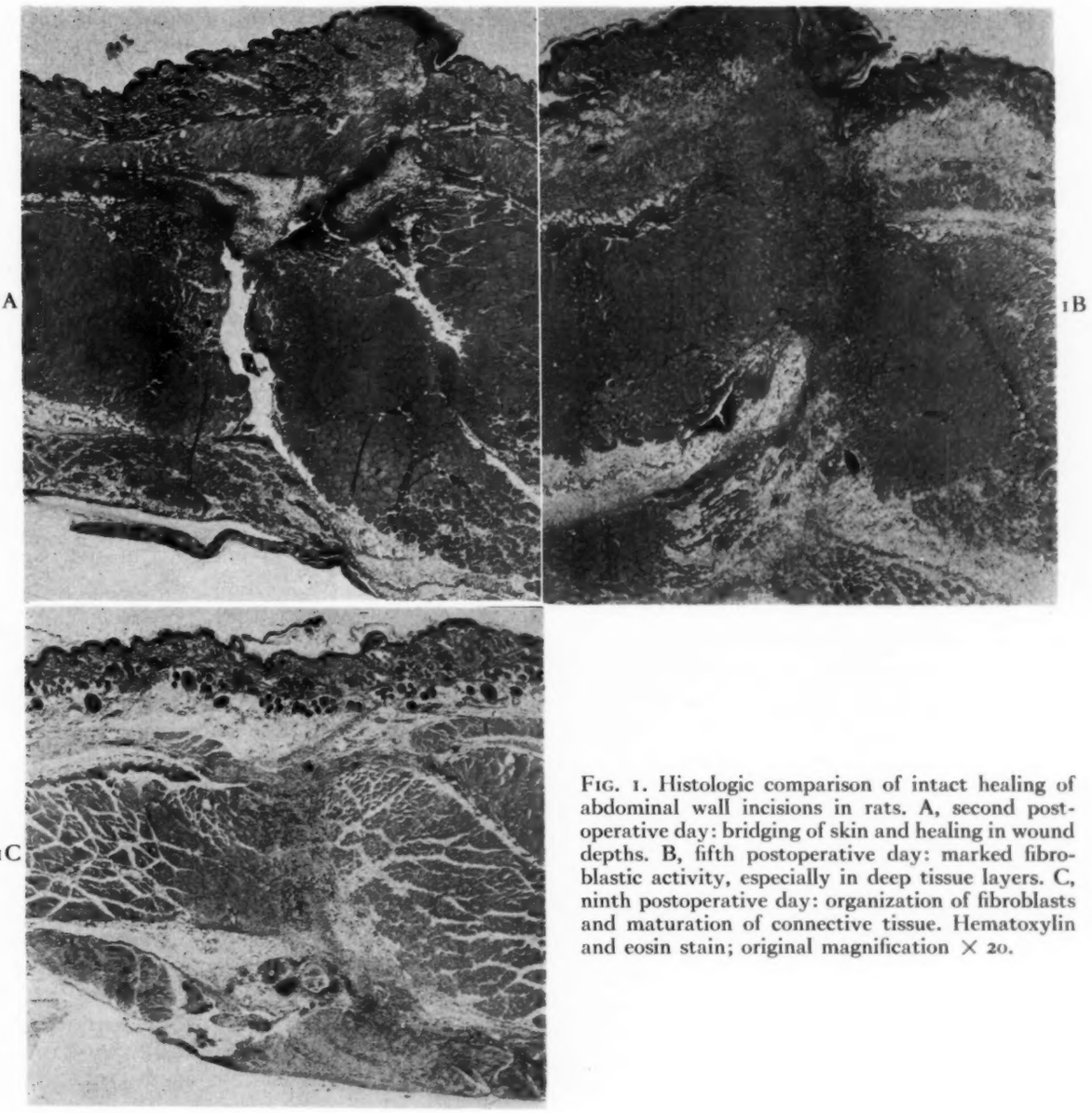
Differences were found between the strength of the superficial portion of the wound and its deep fascia, muscle and peritoneum components at all phases of healing studied. (Table 1.) In each instance the mean bursting strength of the skin was greater than that of the underlying tissue. On the second postoperative day the difference averaged 38 mm. Hg., and following the onset of fibroplasia on the fifth day, it averaged 13 mm. Hg. In the latter stages of healing, however, it was only 6 mm. Hg. In two rats on the ninth postoperative day the skin was of the same strength as the underlying structures, and at the same time in one it was weaker. On the second postoperative day the muscle, fascia and peritoneum layers possessed little, if any adhering strength. At this time the same approximate pressure was required to protrude the balloon through an already disrupted wound as was necessary to disrupt the deep elements of the incision.

Histologic examination (Fig. 1) showed that on the second postoperative day the strength of the superficial aspects of the wound essentially rested on the fact that bridging of epithelium and skin had already occurred, whereas the depth of the wound possessed only blood cells, fibrin and detritus. On the fifth postoperative day fibroblast activity was especially pronounced in the depths of the wound, with considerable reticulin deposition and early collagen formation. This was more pronounced on the ninth postoperative day, with organization of fibroblasts along lines of stress and early differentiation of superficial tissues. Collagen, at this stage, had a more mature appearance and was especially dense at the plane of the anterior rectus fascia.

COMMENTS

Results of this study suggest that during the early stages of healing of abdominal incisions a comparative weakness exists in the deep portions of the wound as against the superficial. Only a modicum of union is present in the skin and subcutis, and even this is not evident in the fascia and muscle until the onset of active fibroplasia. In evaluating these results consideration must be given to the small series of animals and to possible factors of error resulting from various potential causes. The latter include inaccurate construction of a test wound, cutting through of sutures and retractive forces in the tissues. All of these factors conceivably may have played a role in the manner in which disruption developed, but were not deemed as important as the early healing properties of the skin and the development of fibroplasia, especially in the deeper tissues.

Generally, factors concerned with the native healing properties of individual tissues cannot be related to the various manners of clinical



1A 1B 1C

FIG. 1. Histologic comparison of intact healing of abdominal wall incisions in rats. A, second postoperative day: bridging of skin and healing in wound depths. B, fifth postoperative day: marked fibroblastic activity, especially in deep tissue layers. C, ninth postoperative day: organization of fibroblasts and maturation of connective tissue. Hematoxylin and eosin stain; original magnification × 20.

wound dehiscence. Since wounds are united by suture, the strength of these and their holding power account for the real strength in the many layers of the incision. It would only be as a result of some suture accident, or in the period following removal of and loss of holding power by sutures, that the ability of the respective tissues to unite would be critically important. In such rare instances, depending on the extent of the disrupting force, the manner of disruption would be influenced by the strength of union in the individual tissues of the incision.

It has been my impression, based on earlier observations[4] of the manner of experimental wound dehiscence and the observations of Bartlett et al.,[1] that following removal of skin sutures on the seventh to eighth postoperative days, there is a moment of weakness in the superficial elements of the incision as compared to the deeper elements. This, seemingly, was of sufficient magnitude to warrant additional support of the skin for a time. The present experimental study has not altered this viewpoint, but at this period does support increasing appreciation of the binding strength of the superficial tissues.

CONCLUSIONS

A comparative study was made of the healing pattern of the deeper (muscle, fascia and peritoneum) layer and the superficial (skin and subcutaneous tissue) layer of a standard abdominal wall incision in rats. The superficial tissues early showed an ability to unite with minimal fibroplasia and with dominant strength. This latter feature was evident chiefly prior to the onset of active fibroplasia, but generally was maintained with diminishing degree through the ninth postoperative day. With the onset of active fibroplasia, the deeper portions of the wound especially acquired strength, and this increased with fibroblast activity. It is believed that the differences in native healing properties of these components of an abdominal incision do not usually play a significant role in the cause and manner of clinical wound dehiscence.

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Bilateral adrenalectomy has been advised for advanced cases of metastatic breast cancer in which bilateral oöphorectomy and x-ray therapy have already been employed. Some patients may have temporary benefit (especially delay in metastatic spread) following this extensive surgical procedure. In some, bony metastases appear to heal. The average surgeon in our smaller communities, however, is not sufficiently trained to perform this operation adequately. Besides, its merits are still under consideration; hence it would be better to wait for more definite evidence of worth while improvement before advising our patients to undergo this operation. (*Richard A. Leonardo, M.D.*)

The Effect of Hyaluronidase on Experimental Intestinal Adhesions in the Rat

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There are conflicting reports concerning the effect of hyaluronidase on intestinal adhesion formation. One group of investigators first reported a reduction in adhesions following the use of hyaluronidase but later concluded that hyaluronidase had no general applicability in the prevention of intraperitoneal adhesions in the rat.[1,2] Another group of investigators using talc-induced adhesions in the dog concluded that hyaluronidase was of definite value in preventing adhesions.[3] In two of fourteen patients in whom hyaluronidase was used for intestinal adhesions there was no benefit. The other twelve patients had not come to reoperation and no conclusions could be drawn.[4] Experience with rabbits purports that adhesions can be prevented by hyaluronidase.[5]

In order to see whether or not this difference of opinion could be resolved, a series of experiments was designed to determine the effect of hyaluronidase administration in varying concentrations and in varying time periods on experimental visceral adhesions in the rat.

METHODS

The abdomen of white rats (Sprague-Dawley) was opened under ether anesthesia after preliminary skin antisepsis with tincture of mercresin,® and the cecum was then crushed with Kelly's hemostatic forceps for approximately one-half to two-thirds the length of the cecum. The amount of crushing was estimated as enough to cause severe damage short of late necrosis and perforation. Hyaluronidase* in solution, or an equal volume of normal saline in the controls, was placed over the crushed area. The abdomen was then closed with black silk sutures and the animal was either reoperated upon or sacrificed in two weeks. When cecum scraping was done, the same procedure was followed except that instead of cecum crushing approximately one half the circumference of the cecum was scraped of serosa with a scalpel blade for a distance of approximately 20 mm.

The extent and density of the intestinal adhesions formed around the cecum was noted at autopsy or on reoperation. As there is no way of objectively measuring adhesions, careful notes as to their apparent extensiveness and denseness was made by a single observer.

The rats were divided into twenty-two groups. In the first twelve of these groups normal saline solution or hyaluronidase (measured in viscosity-reducing units or VRU) in saline solution was used in varying volumes and with varying concentrations of enzyme to determine the effect of these variables after cecum crushing. In Groups 13 and 14 dry hyaluronidase powder, with and without salt added, was applied locally to the crushed area. Groups 15 through 20 had cecum scraping rather than cecum crushing. Treatment was then varied much as was done with the first twelve groups. Groups 21 and 22 had daily treatment by intraperitoneal injection for fourteen days following the initial cecum crushing.

Controls were furnished in each group of animals by the administration of saline alone. Dense adhesions developed in all of these animals and were graded ++++. It was not possible to measure the density or number of adhesions accurately. However, each treated group was compared with its saline control group. An arbitrary and crude estimate of the number of density of adhesions was made using

* Alidase,® product of G. D. Searle & Company, Chicago, Ill.

+ to ++++ in increasing order of number and density. As there was little variation in the number of adhesions between groups, this grading is mainly an estimation of density.

RESULTS

In Groups 1 through 4 varying concentrations of hyaluronidase were placed in 1 ml. of normal saline and the adhesions measured at the end of two weeks. (Table 1.) The sixteen controls in Group 1 were reoperated upon, the adhesions separated and the abdomen was closed after the instillation of normal saline in eight and hyaluronidase solution in the other eight. In none of the first four groups was there any apparent difference in the number of adhesions formed, either primarily or after lysis. However, in Group 4 in which 2,000 VRU of hyaluronidase were used the adhesions seemed to be less dense than those in the preceding groups. Although the adhesions were as numerous in Group 4 as in the preceding groups, it was somewhat easier to separate the loops of bowel which surrounded the cecum.

TABLE 1

Group	Number of Rats	Treatment*	Volume (ml.)	2 Wk. Survival	Adhesions
1	16	Saline	1	16	++++
	8	Saline	1	8	++++
	8	1,000 units	1	8	++++
2	16	500 units	1	15	++++
3	16	1,000 units	1	16	++++
4	16	2,000 units	1	16	+++
5	8	Saline	5	8	++++
6	8	500 units	5	8	++++
7	8	1,000 units	5	8	++++
8	8	2,000 units	5	8	++++
9	8	Saline	10	8	++++
10	8	500 units	10	8	++++
11	8	1,000 units	10	6	++++
12	8	2,000 units	10	7	++++
13	16	1,400 units in salt	0	7	++++
14	8	1,800 units	0	8	++
15	4	Saline	0.5	4	++++
16	8	2,000 units	0.5	8	+++
17	4	Saline	1	4	++++
18	8	2,000 units	1	8	+++
19	4	Saline	1	4	++++
20	12	1,000 units	1	12	+++
21	12	Saline × 14 days	1/day	10	++++
22	16	1,000 units × 14 days	1/day	12	++

* All animals had cecum crushing done except Groups 15 through 20 which had cecum scraping. Note: Saline means normal saline solution. Units are viscosity reducing units of hyaluronidase.

† Treated following reoperation with lysis of adhesions.

This experiment was repeated in Groups 5 through 8 using 5 ml. to dissolve the saline or hyaluronidase and in Groups 9 through 12 using 10 ml. for the same purpose. In none of the Groups 5 through 12 was there any appreciable difference in the number or density of the adhesions formed when saline controls were compared to hyaluronidase-treated animals. The hyaluronidase used contained enough salt to make a normal saline solution when 1 ml. of sterile distilled water was added to 500 units. In order to determine what effect hyaluronidase and salt in the form of a dry powder had upon these adhesions, 100 mg. of a blend which contained 30.6 gm. of alidase per 454 gm. of sodium chloride were applied to the crushed cecum in Group 13. The alidase in this mixture was assayed at 14 units per mg. which resulted in each rat receiving 1,400 units in about 93 mg. of salt. Of the sixteen rats used, only seven survived to two weeks and all those animals living or dying had extensive intestinal adhesions about the crushed cecum. This was probably due to irritation from the salt placed on traumatized bowel. In Group 14, eight rats had 1,800 units of dry hyaluronidase powder applied to the cecum and all animals survived. No salt had been added to this material. All animals in this group had less dense adhesions than any of the preceding groups and their number seemed to be equal to the minimal number in the other series.

Because cecum crushing was extremely traumatic, as shown by two-week survival rates, cecum scraping was done in Groups 15 through 20. All of the saline controls in these groups had extensive adhesions and all survived to be sacrificed. Those animals treated with hyaluronidase in varying volumes and concentration had a comparable number of adhesions when compared to the control groups. However, the adhesions were freed more readily in the hyaluronidase-treated groups.

Because of the possibility of hyaluronidase being denatured or utilized rather rapidly, a series of animals in Groups 21 and 22 under-

went cecum crushing and fourteen days of treatment. The treatment consisted of intraperitoneal injection of either saline or hyaluronidase in saline given daily for fourteen days. At the end of this time the animals were sacrificed and the adhesions noted as in the other groups. It was found that daily treatment was the most effective way of reducing the density of adhesions. In most of these animals the adhesions were readily separated with a minimal amount of trauma to the bowel wall.

COMMENTS

The only animals in the series studied having a significant reduction in the density of the adhesions were in Group 14 or Group 22. In both these instances a high concentration of hyaluronidase was placed in contact with the area where adhesions would form. In the first instance this was accomplished by using hyaluronidase powder and in the second instance by repeated administrations. Because of the high dosage level used it is probably safe to assume that hyaluronidase will not prevent the formation of visceral adhesions due to trauma in rats. This does not explain why hyaluronidase seems to prevent the formation of adhesions in dogs, although this could be a species difference or a difference in response to talc. On the other hand, in the two patients who have been reported treatment with hyaluronidase did not seem to diminish the number or density of the adhesions. It is possible that a high enough dosage level was not given in these patients to give a satisfactory test.

It would appear that hyaluronidase has some effect, however, on the formation of adhesions as estimated by the ease with which these adhesions can be separated. It is questionable whether or not this effect is significant enough to justify further experimentation in animals unless a method of continuous administration is devised. Other investigators have shown that stimulation of peristalsis alone will produce marked diminution in the density and number of adhesions in experimental animals, thus making objective interpretation of hyaluronidase treatment difficult.[6] Adhesions in the chest can be reduced in experimental animals by the administration of cortisone.[7] However, this it not likely to be a useful method in clinical practice because of widespread systemic effects. If the animal data we have reported can be extrapolated to allow the estimation of a dose for the attempted prevention of intestinal adhesions in the human, massive intraperitoneal doses of hyaluronidase would be required and would probably have to be repeated daily until completion of the healing process.

SUMMARY

Hyaluronidase has been placed on the crushed or scraped cecum of the rat in order to determine its effect on adhesion formation. At very high dosage levels or with continued intraperitoneal administration, hyaluronidase has little effect on the number of adhesions formed but it does seem to reduce the density of these adhesions significantly.

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Retroperitoneal Chylous Cysts

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RETROPERITONEAL cysts which contain chyle are among the rarest of abdominal tumors. The literature consists largely of single case reports;[1] occasionally an author has observed two cases, rarely more. Slocum[2] found six reported from the Massachusetts General Hospital from 1900 to 1926 and Beahrs et al.[3] found nine at the Mayo Clinic from 1911 to 1947.

The reported cases have been reviewed by several authors. In 1936 Parsons[4] collected about 500 cases, in some of which the diagnosis was questioned. In 1948 Vaughn, Lees and Henry[5] summarized the literature, and in 1950 Burnett et al.[6] studied 200 cases reported in sufficient detail to justify conclusions.

Classification. The omentum and mesentery are in reality anterior extensions or inclusions of the retroperitoneal space and hence the cysts found in them, together with those found retroperitoneally without reference to either of these structures, have all come to be grouped together as retroperitoneal cysts.

The various types of cysts which occur in these locations include the following, according to Lahey and Eckerson:[7] (1) lymphatic or chylous cysts, (2) enteric cysts, (3) urogenital cysts, (4) dermoid or teratoid cysts, (5) parasitic and inflammatory cysts, and (6) traumatic hemorrhagic cysts.

The etiology of chylous cysts is unknown. Rokitanski believed they result from degenerated lymph nodes; other observers[8] have suggested an embryonic origin, lymphatic duct obstruction, or effusion of chyle into a preformed cyst.

Pathology. These cysts can occur at any age. In 200 cases reviewed by Burnett et al. the majority occurred in patients well distributed between the ages of ten and fifty years (eleven were under one and six were over sixty); females predominated over males two to one. The cysts occur most frequently within the mesentery, then in the omentum and least often retroperitoneally, not related to the omentum or mesentery. In the mesentery they occur from the duodenum to the rectum, usually in the mesentery of the ileum or small intestine.

They may be solitary or multiple, unilocular or multilocular. Their walls are usually thin, rarely as thick as 1 cm. and microscopically consist of a patchy or continuous low cuboidal epithelial lining on a fibrous fatty base distinguished from the mucosal lining of the enteric type cyst. Smooth muscle may be scattered through the wall; calcium deposits are rarely present.

The contents of the cyst are clear or milky, may be blood-stained or yellow and often contain fibrinous, fatty or sebaceous elements. More exact descriptions of the contents are usually lacking.

The cysts may be small but usually are recognized clinically only as they enlarge, and they may attain huge dimensions (as in Case III).

Chylous cysts are essentially benign lesions but malignant change or primary malignant characteristics do occur and were present in two cases from the Mayo Clinic.

Symptoms and Findings. A retroperitoneal chylous cyst in itself produces no symptoms other than the presence of the tumor which may be discovered by the patient or by the physician in the course of an examination. Symptoms usually arise from complications, and in 40 per cent they consist of partial or intermittent intestinal obstruction from pressure of a mesenteric cyst on the bowel. This produces colicky pain, nausea, vomiting and hyperperistalsis which occur in intermittent attacks or as a single, severe and progressive episode.

Torsion, spontaneous or traumatic rupture, peritonitis, hemorrhage into the cyst or acute infection may produce abdominal episodes recognizable only as an acute condition of the abdomen. If the cyst is palpable, it is smooth and often freely movable; occasionally it is fixed and tender. Incarceration of the cyst in

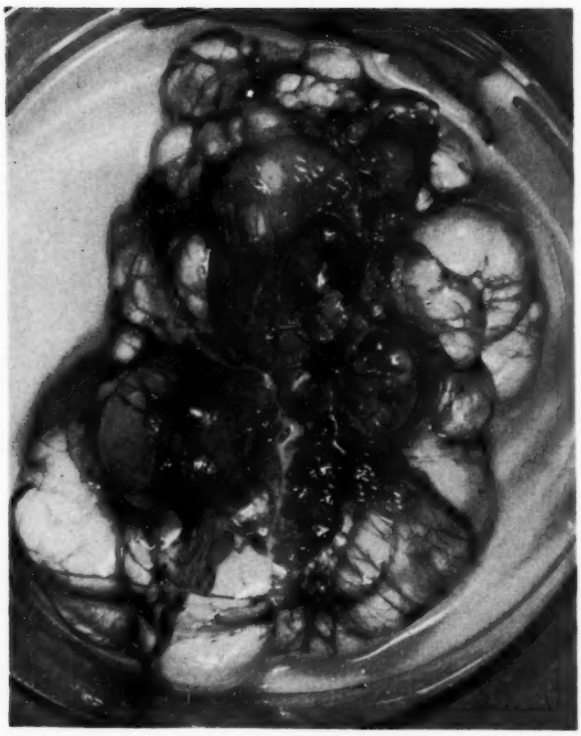

FIG. 1. Case 1. Large multilocular retroperitoneal chylous cyst.

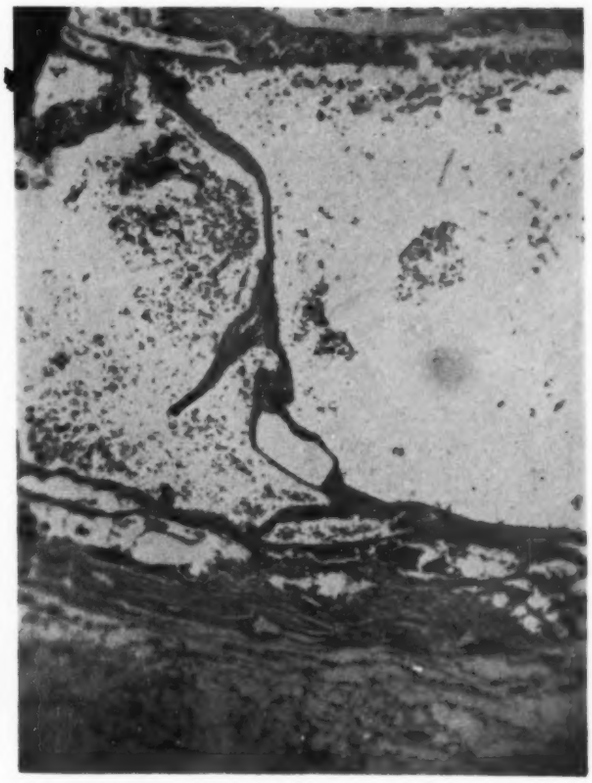

FIG. 2. Case 11. Multilocular retroperitoneal chylous cysts (low power field).

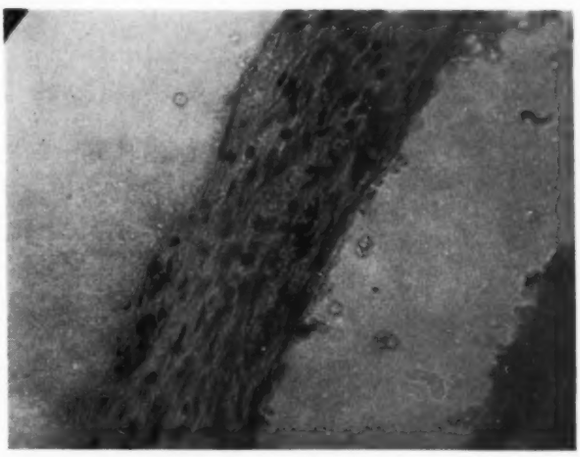

FIG. 3. Case 11. Chylous cyst wall with patchy cuboidal epithelial lining.

the pelvis, malignancy or extreme size all modify the symptoms somewhat.

Roentgenograms may reveal a soft tissue mass; sometimes there is renal or bowel displacement. Calcification is rarely seen.

None of these findings are characteristic, however, and the condition is usually not diagnosed clinically. However, it should be suspected if an intra-abdominal mass is not otherwise accounted for, especially if it is associated with intermittent or acute intestinal obstruction.

Treatment. Treatment consists of enucleation or excision. The loose areolar attachments of a chylous cyst usually facilitate enucleation. However, when the mesenteric blood supply is impaired, bowel resection may be necessary and in rare instances excision of the cyst itself is technically very difficult or impossible. Since these are essentially benign lesions, their removal is desirable and the results justify the operation even when it is tedious and difficult.

Incision and drainage, and aspiration reduce the size of the cyst and facilitate its removal, but are usually not in themselves acceptable present day methods of treatment. Marsupialization is justified only in extreme cases when removal is impossible; it results in drainage which persists but eventually ceases, with acceptable results in most instances.

CASE REPORTS

CASE 1.* In August, 1946, the patient, a forty-three year old woman, became aware of

* This case has been previously reported.[9]

FIG. 4. Case III. Intravenous pyelogram with soft tissue mass in right renal area and medial displacement of the right kidney.

FIG. 5. Case III. One year later with increased right renal displacement.

a mass in the right upper abdomen, particularly noticeable when first lying down. On the first examination a tumor was not palpated, but a second examination revealed a movable, non-tender grapefruit-sized mass. Intravenous pyelograms and roentgenograms of the colon were normal.

In August, 1946, exploration for a possible omental tumor revealed a large retroperitoneal cyst within the hepatic flexure of the colon. It was entirely retroperitoneal; a larger portion bulged into the abdomen, and a smaller portion was situated deep between the duodenum, the head of the pancreas and the inner aspect of the right kidney.

The cyst was easily enucleated but was ruptured anteriorly where the peritoneum was intimately attached to it. Convalescence was uneventful and the patient was well nine years later.

Pathologic examination revealed a multilocular cyst, 15 by 15 by 5 cm. in size and filled with milky fluid. (Fig. 1.) The walls were paper-thin and traversed by a coarse vascular network. The inner surface was grossly smooth and no projections were visible microscopically. It was lined with flat endothelial cells on a dense connective tissue layer with fat cells and perivascular lymph infiltration. The fluid had a specific gravity of 1.020 and contained numerous fat globules and rare lymphocytes. The diagnosis was cystic lymphangioma with chylous contents.

CASE II. This patient, a twenty-five year old woman, had had four attacks of sudden epigastric pain radiating into the back during the previous six years. There was no relation to eating and no nausea or vomiting. Her condition was first thought to be functional but on June 5, 1952, two weeks after marriage, pain was again present in the lower abdomen and back with slight abdominal distention and nausea. A tumor, the size of a six months' pregnancy, was palpable in the mid-abdomen anterior to the uterus, and persisted after catheterization.

Ovarian cysts were diagnosed. Exploration on June 7, 1952, revealed three cysts in the mesentery of the ileum about 3, 6 and 9 cm. in diameter, respectively. These were adjacent to, but did not communicate with, each other. They were enucleated without difficulty or significant injury to the blood supply of the ileum. The patient convalesced uneventfully and in January, 1954, she was well except for menstrual irregularity with slight enlargement of the right ovary.

The wall of the cyst measured from .2 to .4 cm. in thickness. The inner surface appeared reddish yellow and was covered by fibrous-like

material. The contents appeared milky. Microscopically the cyst was multilocular (Fig. 2) and lined with patchy low cuboidal epithelium. (Fig. 3.)

CASE III. This patient, a sixty-eight year old man, had had anemia with achlorhydria

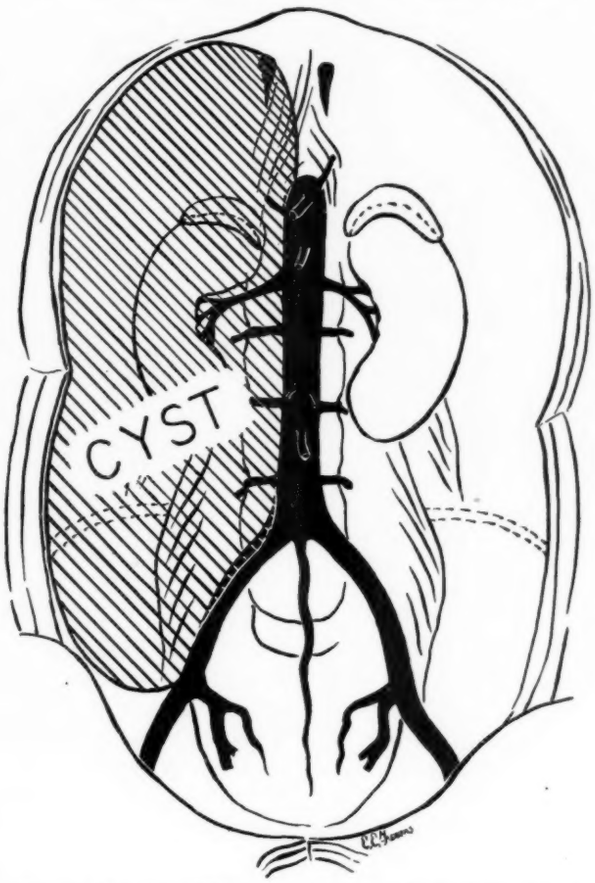

FIG. 6. Case III. Diagrammatic sketch to show extent (shaded area) of huge retroperitoneal chylous cyst.

and abdominal distention for twelve years. Hydrochloric acid and iron gave some improvement. In November, 1952, he was hospitalized for pneumonia of the left base notable for excessive purulent sputum. There was considerable abdominal pain and distention at the onset and a tender fixed mass was palpated in the right abdomen.

The mass persisted after recovery from pneumonia. An intravenous pyelogram on January 12, 1952, revealed a normal right kidney and ureter displaced medially by a soft tissue mass in the right abdomen. (Fig. 4.) Similar studies in 1941 had been normal. The stomach and colon were normal roentgenologically. There was fusion of D11, D12 and L1. A retroperitoneal mass was diagnosed but operation was declined because of lack of symptoms. One year later the condition was unchanged. Blood findings were normal and intravenous pyelograms revealed increased medial displacement of the right kidney. (Fig. 5.)

On November 4, 1953, at exploration the right retroperitoneal space was found occupied by a huge cystic mass which extended from the iliac fossa to the diaphragm. (Fig. 6.) It displaced the right kidney medially and was attached to the vertebra. The abdomen was opened through a short incision in the peritoneum, found normal, and the peritoneum was closed. About 2 quarts of milky fluid were drained from the cyst. Its walls were very intimately attached to the surrounding structures and cleavage planes were not present. It could only be removed with difficulty by tedious sharp dissection. For these reasons and the age and condition of the patient, the feasibility of its removal was questioned even though it was necessary to accomplish a cure.

It was first dissected free around its midportion, then in the lower pelvis and finally the superior portion. The retroperitoneal space was drained.

The patient's convalescence was complicated by pneumonia, but otherwise was uneventful. In December, 1955, his condition was excellent.

Pathologic examination revealed that the milky fluid contained spongy fibrinous material. Microscopically, neutrophils and a few erythrocytes were present. The cyst wall varied from ⅛ to ¼ inch in thickness, and the inner surface was smooth with scattered endothelial lining on a thick fibrous base containing much collagen and occasional muscle fibers. Scattered collections of neutrophils, monocytes and a few giant cells were observed. (Fig. 7.) Externally the wall presented a shaggy appearance due to attached fragments of muscle and fibrous tissue.

COMMENTS

Three cases of retroperitoneal chylous cysts have been reported. One was intramesenteric, and two were retroperitoneal without reference to the mesentery or omentum, the most unusual location for these cysts. Two were without complications or symptoms, the tumor being discovered accidently by the patient or the physician. The patient in Case II presented the typical picture of a large tumor with a history of partial intestinal obstruction recurring over a period of six years. The patient in Case III

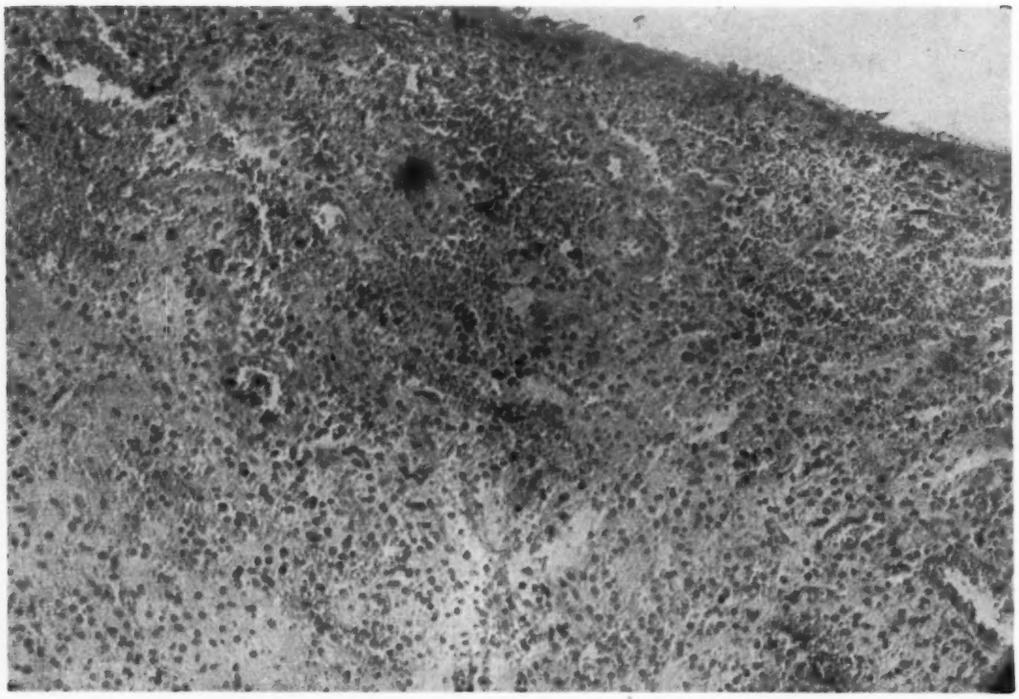

FIG. 7. Case III. Microscopic appearance of cyst wall. Note scattered endothelial lining on thick fibrous base; neutrophilic and monocytic infiltration with scattered hemorrhages.

had an unusually large cyst with intimate attachment to the surrounding tissues; even after drainage the feasibility of its removal was questioned. However, an attempted removal seemed imperative since there was no evidence of malignancy, and only complete removal promised a cure. This was successfully accomplished after drainage, the cyst wall was dissected free around its mid-portion, the inferior portion was then dissected out and finally the superior portion. Thus, if the patient's condition or technical difficulties had necessitated termination of the operation at any stage, the remaining portion of the cyst would have been superior and most amenable to marsupialization or drainage.

SUMMARY

Retroperitoneal chylous cysts are rare but are surgically important because they can cause severe symptoms due to their complications.

The most frequent complication is intermittent or partial intestinal obstruction, but rupture, incarceration in the pelvis, infection, hemorrhage into the cyst, calcification of the cyst wall and malignant changes may occur.

The diagnosis is difficult to make preoperatively but should be suspected in the presence of an abdominal mass associated with intermittent or complete intestinal obstruction.

The treatment is removal, which is quite feasible unless made impossible by extensive involvement of the blood supply of the intestine.

The mortality has been considerable in the past but should be greatly minimized by modern surgical methods.

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Parietal Entero-uterine Fistula

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A CASE of parietal entero-uterine fistula is reported, the first such case treated in the Robert Packer Hospital.

A review of the literature indicates that seventy-three cases of entero-uterine fistula have been reported. In 1933 Danforth and Case[1] recorded a case of entero-uterine fistula which was of carcinomatous origin. Until then only fifty-eight cases of similar fistulas had been reported, most of these by Le Jemtel[2] and Neugebaur.[3] In 1939 Dwyer[4] recorded his case of sigmoido-uterine fistula and thirteen additional cases. Dwyer's case occurred following spontaneous rupture of a gravid uterus, with the fetal skull bones perforating into the lumen of the intestine. The patient recovered following extensive surgery which included preliminary emptying of the uterus, supracervical hysterectomy, resection of the ileum and closure of the opening in the sigmoid colon. In 1945 Rose[5] reported still another case, which occurred in a young woman delivered of a stillborn child; subsequently the woman was proved by surgery to have a fistula between the small intestine and one horn of a uterus bicornis. In this case Rose believes that the fistula resulted from an attempt to end the pregnancy. Rose's case is the seventy-third case recorded in the literature.

Recently, another case of entero-uterine fistula was reported by Johnston and Stubbs.[6] This last case was the result of ruptured diverticulitis.

The case presented herein is the seventy-fifth case of entero-uterine fistula. However, none of the previously recorded cases mentioned any other involvement besides intestinal and uterine components to the fistula. Our case appears to be the only one involving a third component, that of the anterior abdominal wall; hence the name parietal entero-uterine fistula.

Le Jemtel[2] classifies entero-uterine fistulas etiologically as follows: (1) Cancer: by infiltration and invasion by a malignancy arising either in the bowel or uterus and invading the other structure with subsequent communication of the lumens. (2) Peritonitis: pathologic puerperium, and appendicular. This follows infection with abscess formation involving the inflamed walls of the uterus and intestine, resulting in subsequent communication. Under this classification should be added the fistula arising secondary to ruptured diverticulitis. This was the mechanism of Noecker's[7] case reported in 1929 and Johnston and Stubbs'[6] case recorded in 1955. (3) Ruptures of the uterus either spontaneous or produced during labor. A loop of bowel is thus entrapped within the uterine tear, following which strangulation of the bowel results when the uterus contracts. Gangrene results and the intestinal contents escape by way of the genital cavity.

In the series of fifty-eight cases recorded by Le Jemtel,[2] thirty-seven followed injury, fourteen after inflammatory processes and only seven cases after carcinoma. With the better management of obstetric complications and inflammatory abdominal disease, it would be reasonable to expect that most of these fistulas (if not all) will arise secondary to abdominal carcinoma.

The location of the fistulous tracts is usually between the fundus of the uterus or point of injury to the uterine wall, and the small intestine, sigmoid, rectum, cecum or even the stomach. At times the exact site of the intestinal rent cannot be demonstrated except by x-ray or at surgery.

Diagnosis is essential so that proper therapy may be instituted. The clinical history of profuse uterovaginal discharge which may be fecal in character or contain undigested food is the "tip-off." Examination will reveal that the discharge emanates from the uterus and not via a vaginal component of a rectovaginal fistula. Past history of intra-abdominal inflammatory disease (appendicitis or diverticulitis), or operative or obstetric trauma is helpful

FIG. 1. Barium enema demonstrating fistula between the uterus and rectosigmoid.

FIG. 2. Roentgenogram demonstrating abdominal sinus tract entering uterine cavity.

in making the diagnosis. A mass may be palpable in the pelvis on examination. The diagnosis is confirmed on examination with barium enema x-ray by outlining the fistulous tract between the large bowel and the uterus. (Fig. 1.) However, in the instances where the fistula communicates with the small bowel, a gastroduodenal x-ray with follow-through should be done to prove the diagnosis. The injection of dye via the cervical os to outline the uterus fistulous tract and bowel is not recommended as this might spread infection or carcinoma beyond its confined barriers. Following corrective surgery, this procedure might be used effectively to prove that the fistula is completely repaired. In our case the parietal component of the fistula was visualized by the injection of dye through the tract extending from the abdominal wall. (Fig. 2.)

TREATMENT

The site and etiology of the fistula will influence the treatment. Those patients with fistulas due to carcinoma can be offered little in the way of surgical cure. They can be made happy and comfortable by clearing up the uterovaginal discharge with proximal colostomy to the fistula.

Those fistulas due to trauma, diverticulitis or inflammation may be amenable to surgical cure. After preliminary preparation with antibiotics, bowel sterilization, diet and transfusions, surgery may be performed and the involved viscera separated and the openings sutured. Where there is considerable reaction and inflammation or the rent in the bowel cannot be effectively closed, the involved bowel should be resected with anastomosis. Subtotal hysterectomy may even be performed at this time in those cases in which uterine repair cannot be carried out effectively or in those patients beyond the child-bearing age.

In our case proximal colostomy was performed and the result was most gratifying to the patient. The fecal vaginal discharge ceased and the abdominal sinus closed spontaneously.

CASE REPORT

A fifty-five year old white woman entered the hospital on November 14, 1954, with the complaint of fecal drainage from the anterior abdominal wall and vagina. Family history was non-contributory. The patient had always enjoyed perfect health. Two pregnancies had been successful with no complications or difficulty with either delivery, and there was

no history of miscarriage. The patient had been well until October, 1947, when symptoms developed which were consistent with diagnosis of bowel obstruction. Surgery was performed at another hospital and a transverse colostomy was performed. She was told that she had numerous adhesions and that there was a "hard inflammatory abscess on the spine." Biopsy of this mass was reported as negative. Following surgery the colostomy failed to function and the patient had bowel movements per rectum. One week after surgery the colostomy was closed.

One year later a hernia developed at the old colostomy site (the upper right quadrant) but this never bothered the patient. After her discharge from the hospital menorrhagia developed and she was advised to take eighteen x-ray treatments, which stopped her menses completely. She was well for five years thereafter; she gained weight, had excellent appetite and normal bowel movements.

In December, 1952, she began having abdominal cramps, nausea and vomiting, constipation and rectal bleeding. A barium enema at this time revealed extrinsic pressure on the wall of the rectum with narrowing of the lumen. Surgery was advised and accepted. At surgery the left ovary was greatly enlarged and attached to the colon, uterus and pelvic floor. The uterus was myomatous and the right ovary was also enlarged. In the surgeon's judgment this was an inoperable frozen pelvis due to carcinomatosis. A biopsy specimen was taken of the left ovary. The pathologist's opinion of the biopsy was adenocarcinoma, grade III, probably originating from the ovary or urinary tract. The patient made an uneventful recovery from the operation. She was told she had inoperable cancer, and deep therapy was advised and instituted. After ten treatments the recent left paramedian incision opened. After a rest period of ten days, eight more treatments were given. From this time on the incision would intermittently open and drain. The patient treated the wound with proprietary ointments, with symptomatic relief.

For a period of two years she made no progress; the abdominal sinus would drain intermittently and fecal material and gas would escape, and then the sinus would "dry up." Her bowels were regular but the stools were pencil-sized and she would pass blood. She lost 40 to 60 pounds in weight, but this did not concern her as she had been overweight from the start. Her appetite was only fair.

In August, 1954, fecal material started draining from the patients' vagina for the first time. Late in October, 1954, a moderate-sized abscess developed in the abdominal wound, which drained spontaneously.

Examination on the present admission showed the patient's blood pressure to be 120/80, pulse 80 and weight 138 pounds. She was cooperative but had definite ideas about her illness. Examination was negative except for the abdomen where there was a moderately large incisional hernia in the upper right quadrant with overlying skin considerably thinned out and a hernia ring 4 cm. in diameter. The skin of the lower abdomen was tanned from x-ray treatment and there was a lower left rectus scar with two sinus openings which were discharging mucopurulent material. There was no inguinal adenopathy. Pelvic examination revealed a normal cervix and fecal material issuing from the os. The uterus could not be outlined and was incorporated in a large, firm, tender mass which filled the pelvis. There was no peripheral edema.

Laboratory studies were within normal limits except for a blood volume deficit of 1,200 ml.

On November 18th an x-ray examination was made of the sinus tract. Under fluoroscopic control iodochloral® was introduced into a catheter inserted in the abdominal sinus tract. The iodochloral was seen to flow through a tortuous channel and finally enter the left cornu of the uterus with subsequent outlining of the uterine cavity and the vagina. (Fig. 2.) Following this the rectum and sigmoid were filled with barium from below. There was marked narrowing at the rectosigmoid junction, this narrowed area being tapered at the ends and giving the impression of a granulomatous lesion at this level. (Fig. 1.) There also appeared to be a sinus tract arising from this narrowed area and communicating with the uterus, and the impression was obtained that there might be another sinus tract between the uterus and mid-sigmoid. (Fig. 1.) It was our impression that there were multiple sinus tracts between the rectum, uterus, sigmoid and anterior abdominal wall.

The cardiologist evaluated the patient as suitable for surgery. Proctologic survey revealed multiple fissures. Examination was

possible only to 4½ inches because of a large pelvic mass occluding the lumen. No fistulous openings were seen when carmine red was used.

The patient was prepared for surgery with multiple blood transfusions and sterilization of bowel. Operation was performed on November 22, 1954. This patient had a known carcinoma of the ovary, first discovered approximately six years before. At the time of operation she had a large bowel–uterine–abdominal fistula and fecal material was discharging from both a lower abdominal wound and through the vagina. These findings were demonstrable on x-ray both by lipiodol injection through the abdominal sinus and by barium enema; in both cases the uterus was outlined first with lipiodol and then with barium. The patient also had a stricture at the rectosigmoid junction but had been able to have bowel movements, although the caliber of these had been small and pencil-sized. The best that could be hoped for at that time was to short-circuit the large bowel and thus prevent the discharge of fecal material through the abdominal sinus and the vagina. The patient withstood transverse colostomy very well.

On November 23rd the colostomy opened with cautery. The following day the colostomy opening was enlarged, providing much relief as flatus was passed. On November 29th the loop colostomy was completely severed.

The patient started having bowel movements by way of the proximal loop with the help of enemas; subsequently the bowel movements became spontaneous. The abdominal wall sinus no longer drained and closed spontaneously. The vaginal discharge subsided and at the time the patient left the hospital on December 8th there was no vaginal discharge whatever. There was a small amount of mucoid discharge per rectum.

The patient was very happy and comfortable although she realized she was not cured.

CONCLUSION AND SUMMARY

The number of recorded cases of entero-uterine fistula is small. This is strange in view of the incidence of pelvic cancer in females. This may be due to the resistance of the uterine wall to invasion from the outside by carcinoma.

Our case differs from the other cases of entero-uterine fistulas in that a parietal component was involved; hence the name parietal entero-uterine fistula. As far as could be determined, the case under study was the result of either carcinoma or radiation therapy.

In spite of the fact that cure may be impossible in those cases in which carcinoma is the cause, great relief may be offered to the patient by the simple expedient of a proximal colostomy. Where trauma or infection causes the fistula, direct surgical repair may be possible with complete cure.

Entero-uterine fistulas may be more prevalent than is indicated by the number of cases reported in the literature. Such cases should be recorded whenever they occur and are recognized, so that they will be better understood.

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Feculent Vomiting

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THIS article was prompted by experience with a patient who had feculent vomiting but did not have intestinal obstruction, and by the startling observation of a patient vomiting barium immediately after a barium enema. The vomiting of feculent material is given scant attention in medical literature. We have found only five references to this subject since 1900.[1–5]

The vomiting of formed feces is a rare occurrence. It usually is caused by coprophagy or gastrocolic fistulas. The vomiting of liquid material from the lower part of the small intestine is not as rare. In most clinical instances the resemblance to feces is in odor rather than in appearance. One could hardly improve upon the description given by Howell[3]: " . . . fecal vomiting is the last stage of a rising tide of vomit which passes within a few days through a gamut of colors from a bilious yellow through light and dark green to this pea soupy, foul smelling vomit, and ends, if the cause has not been removed, in an ebb tide of exhaustion and death."

Until the present study was completed the authors were under the impression that feculent vomiting was always caused by mechanical intestinal obstruction. However, we have encountered several cases of feculent vomiting caused by paralytic obstruction of the bowel (adynamic ileus) and one interesting example of violent reverse peristalsis. The following is a brief account of the case of reverse peristalsis:

An eighty-one year old white man was admitted to a private hospital complaining of cramping lower abdominal pain and abdominal distention. For the preceding month he had noted constipation, "gas pains" in the lower abdomen and distention which was relieved by enemas and by passing flatus. The symptoms had become worse during the twenty-four hours before admission and had not been relieved by enemas. On admission the physical examination was essentially negative except for lower abdominal distention. The peristaltic sounds were not recorded on the clinical chart. Colonic disease was suspected, so a barium enema was given. Numerous small diverticula of the lower descending and sigmoid portions of the colon were demonstrated. Normal reflux of the barium mixture through the ileocecal valve into the terminal ileum was seen during fluoroscopy. The x-ray of the abdomen taken immediately following fluoroscopy demonstrated marked retrograde reflux of the barium into the proximal jejunum. (Fig. 1.) The postevacuation film demonstrated that there was reflux of the barium throughout the small bowel and into the stomach. (Fig. 2.) Immediately after the postevacuation x-ray was made the patient vomited a large amount of the barium mixture. Five hours later x-ray demonstrated that there was still some barium in the stomach and scattered barium in the small bowel and colon. The patient recovered from his symptoms. A definite diagnosis was not established although an episode of mesenteric thrombosis of minor degree was strongly suspected. Such a condition might have accounted for a disturbance of peristaltic gradients in the intestine. Six months later the patient had an upper gastrointestinal x-ray study which was essentially normal and a barium enema which again revealed the colonic diverticula and a normal reflux of barium into the small bowel, but did not demonstrate the abnormal reflux proximally even though adequate opportunity was permitted for this to occur.

Other interesting examples of violent reverse peristalsis were collected by Weber.[4] He cited the story of a man who vomited a suppository which had been introduced into his rectum. Weber had a personal case of a twenty-two year old woman who had abdominal distention and constipation, and vomited formed feces and scybala at times. These symptoms fol-

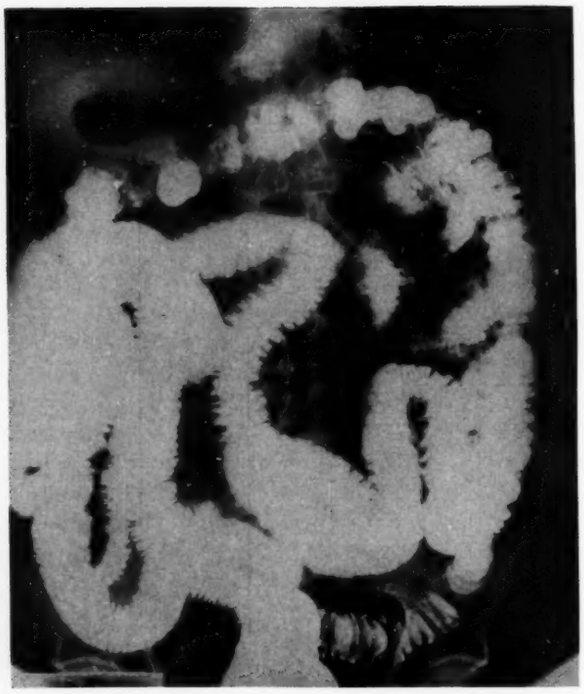

FIG. 1. Pre-evacuation barium enema x-ray demonstrating reflux of barium into the proximal jejunum.

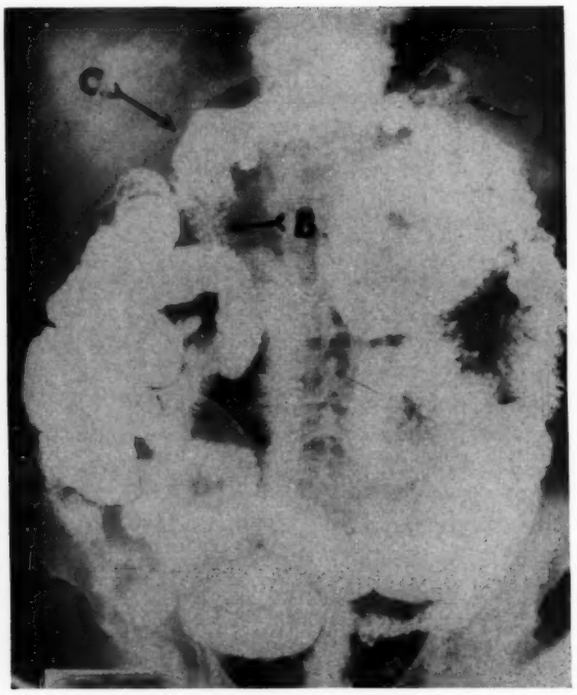

FIG. 2. Post-evacuation barium enema x-ray demonstrating reflux of barium into the duodenum and stomach. A, stomach; B, descending duodenum; C, transverse colon.

lowed severe psychic trauma. Her husband had had hemoptysis on the night of marriage and died soon after. Extensive investigation did not reveal any organic cause of her trouble. Methylene blue given by enema appeared in the vomitus in ten minutes. The patient underwent two laparotomies but no abnormalities were found. On one of these occasions the stomach was opened. A third laparotomy was performed by Sir Francis Treves and no pathologic condition was found. This patient definitely exhibited signs of hysteria. Her symptoms were improved when she was left alone.

Weber cited Jaccouds' case of an hysterical woman who vomited feces. Autopsy did not reveal a cause for the condition. Weber also mentioned Tullio's patient, in whom reverse peristalsis could be observed through the abdominal wall. This peristalsis started in the region of the sigmoid and progressed to the ileocecal valve, and then to the pyloric region where a lump formed and increased in size until the patient vomited feces or an enema which had been given. Weber stated that Longmann of New York in 1889 reported the case of a twenty-one year old woman who vomited scybalous masses. At laparotomy a darning needle was found impacted in the anterior wall of the stomach between the serous and mucous coats. This was removed but the patient had the same symptoms after surgery. She vomited enemas containing indigo in nine minutes.

These examples probably represent instances of violent reverse peristalsis which certainly must be the mechanism required to pass formed feces and liquid up from the colon through the ileocecal valve. Such movements are more likely to occur in an intestine with normal muscular walls than in an intestine weakened by disease or overdistention. Such violent antiperistalsis is more inclined to be due to nervous derangement than to organic obstruction of the intestine.

CLINICAL MATERIAL

During a two-year period at the Los Angeles County Harbor General Hospital twenty-three cases in which feculent vomiting occurred were recorded and the case histories carefully reviewed. (Table 1.) It is not surprising that most of the cases of feculent vomiting were due to mechanical small bowel obstruction and a few due to mechanical large bowel obstruction, but it is surprising that four of the

cases were due to paralytic obstruction (adynamic ileus). These four cases are presented briefly.

CASE I. A. D. (Hospital No. 51336), an eighty-six year old white woman, was admitted to the orthopedic service because of a fracture of the right femur through an area of Paget's disease. On admission abdominal examination was essentially negative except for slight generalized distention. The distention gradually increased. On the fifteenth hospital day the patient vomited a large quantity of feculent material. Surgical consultation was requested and the patient was seen at surgical rounds on that day. Abdominal exploration was advised on the basis of enormous distention, feculent vomiting and dilated small bowel seen on x-ray. Bowel sounds were infrequent and high pitched. At surgery all of the small bowel was noted to be greatly dilated; however, no point of mechanical obstruction was found although the entire bowel was carefully searched. Postoperatively the patient remained distended in spite of all efforts to decompress the bowel. Evisceration occurred. Secondary closure of the wound was done but the patient died on the fourteenth postoperative day. There was no autopsy.

TABLE I
CAUSES OF FECULENT VOMITING IN TWENTY-THREE CASES

Mechanical small bowel obstruction	16
Adhesions	9
Carcinomatosis	4
Femoral hernia	2
Gallstone ileus	1
Mechanical large bowel obstruction	3
Cecal volvulus	1
Carcinoma of sigmoid	1
Fecal impaction	1
Paralytic obstruction (adynamic ileus)	4

CASE II. F. M. (Hospital No. 11693), a ninety-one year old white man, was admitted to the urologic service because of nocturia, suprapubic pain and urinary retention. He had undergone transurethral resection of the prostate three years previously. On admission he was found to be in congestive heart failure and to have a moderately obese abdomen with no scars. There was slight suprapubic tenderness. There was an easily reducible left inguinal hernia. After admission abdominal distention developed and the patient vomited feculent fluid on several occasions. There were no peristaltic sounds. An x-ray of the abdomen was consistent with marked paralytic ileus. Subsequently bowel sounds returned, distention diminished, and gas and feces were passed per rectum. The patient was transferred to the medical service and eventually died of heart failure. There was no autopsy.

CASE III. A. S. (Hospital No. 62993), a seventy-four year old white woman, was admitted to the surgical service for treatment of squamous cell carcinoma of the anus. An abdominoperineal resection was performed. The patient had an extremely stormy postoperative course characterized by abdominal distention. Feculent fluid was vomited on several occasions despite decompressive measures. The patient died on the fourteenth postoperative day. Autopsy disclosed a dilated small bowel due to peritonitis but no evidence of mechanical small bowel obstruction.

CASE IV. W. C. (Hospital No. 87525), a sixty-one year old white man, was admitted to the surgical service for treatment of adenocarcinoma of the rectum. At surgery a fixed mass was found at the peritoneal reflection. There were extensive intraabdominal metastases including hepatic metastases. Sigmoid colostomy was performed. Following surgery abdominal distention occurred. The colostomy was opened but did not function well. On the seventh postoperative day the patient vomited feculent material. Laparotomy was performed but no point of mechanical intestinal obstruction could be found. The small bowel and colon were greatly dilated. Following surgery the patient continued to vomit feculent fluid in spite of a long intestinal tube. He died on the twenty-sixth postoperative day. There was no autopsy.

COMMENT

The terminal ileum ordinarily holds fluid material containing many viable coliform bacilli. As a result of increasing distention of the bowel, intestinal secretion becomes markedly increased and absorption from the intestine concomitantly decreased. The bowel becomes laden with large quantities of toxic fluid.[6] Indole and skatole are produced from trytophane by putrefaction of protein. Methane, methyl mercaptan, butyric acid, phenol and hydrogen sulfide are additional substances which are formed and impart the characteristic odor of feces. This foul-smelling fluid fills the bowel lumen. As a result of inhibition or

paralysis of the intestine there may be relaxation of the pyloric sphincter which allows abnormal regurgitation of the intestinal contents into the stomach from which, because of an overflow mechanism, it is vomited. However, according to the metabolic gradient theory of Alvarez, the inflammatory or irritative process causing the distention will increase the metabolic rate at the point of irritation, thereby reversing the gradient of the bowel and thus causing reverse peristalsis.

It is interesting to note that the four patients in this series who had feculent vomiting of paralytic origin (adynamic ileus) were in the seventh, eighth, ninth and tenth decades. The patient who had reverse peristalsis demonstrated on barium enema x-ray study was in the ninth decade. Thus it seems that feculent vomiting not due to mechanical intestinal obstruction is associated with advanced age. Presumably this is due to decreased tone of the gastrointestinal tract leading to greater distention and possibly to easier reversal of peristaltic gradients.

SUMMARY

The vomiting of feces is an unusual symptom associated with gastrocolic fistulas, coprophagy and violent reverse peristalsis.

Feculent vomiting is usually due to mechanical intestinal obstruction but it can be due to paralytic obstruction (adynamic ileus). In a two-year period at Los Angeles County Harbor General Hospital there were twenty-three cases of feculent vomiting; nineteen were due to mechanical intestinal obstruction and four were due to paralytic obstruction.

It is important to know that feculent vomiting is not necessarily a pathognomonic sign of mechanical intestinal obstruction but can also occur in paralytic obstruction, particularly in aged patients. Recognition of this fact might avoid needless surgery in these desperately ill persons.

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Bilateral Simultaneous Tubal Pregnancy

REVIEW OF LITERATURE AND REPORT OF CASE

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The fallopian tubes can be the site of multiple pregnancies. In general there are three types: (1) unilateral tubal twin pregnancy; (2) bilateral tubal twin pregnancy; and (3) tubo-uterine pregnancy where a fetus may be present in one or both tubes and in the uterus. Arey[1] stated that the tendency to produce double ovum "twins," which really are not twins at all, is often hereditary. Single ovum twinning on the contrary is not directly heritable but is the result of immediate environmental influence on the course of development. Torpin[2] points out that simultaneous bilateral tubal pregnancy must be considered a form of double ovum twin pregnancy. The same is true of simultaneous pregnancy in the uterus and the fallopian tube, so-called heterotopic pregnancy. Of the two conditions, the latter is much more common as there were over 300 instances reported in the literature by 1940. The rarity of bilateral simultaneous tubal pregnancy is shown by the fact that at the time of Fishback's[3] report in 1939 there were only seventy-five authenticated cases. He added one personal case, making a total of seventy-six. It was indicated in this paper that descriptions of the placenta and fetuses or portions of them were essential for proof of the presence of the condition. In addition, microscopic examinations were often necessary to confirm the diagnosis and to fix pregnancy periods.

Utilizing the criteria established by Fishback, reports in the literature on this subject have been brought up-to-date in this article. Thirty-three additional cases were reported between 1939 and 1954. During the course of this investigation all questionable instances that did not fulfill the conditions outlined heretofore were eliminated. Another case of bilateral simultaneous tubal pregnancy is reported in this review of the subject, making thirty-four additional cases in all which have been reported since 1939. These new instances when added to those described by Fishback make an over-all total of 110 cases of bilateral simultaneous tubal pregnancy which have been reported in the literature through the year 1954.

The following is a résumé of the history and findings in a case of bilateral tubal gestation.

CASE REPORT

The patient was a thirty-three year old woman who had begun to menstruate at twelve years of age. Her periods were fairly regular, coming about every twenty-five to twenty-eight days. The duration was three to four days. She never had excessive pain or flow with her periods.

The patient's last menstrual period came on November 24, 1952, at the expected time, and it was normal in all respects. She did not menstruate in December, 1952. The patient began what she thought was her next period on January 2, 1953. However, after twenty-four hours the heavy flow stopped but daily thereafter she continued to have spotting composed of dark, bloody material.

About midnight on January 6, 1953, sudden, severe pain developed in the lower abdomen; the pain was most marked on the left side. Rest in bed and morphine administered by her doctor eased the pain, but the distress returned with increased severity throughout the entire lower abdomen when the patient arose about 8:00 A.M. that morning.

The patient had been married twelve years. Her husband was well but she had had no pregnancies.

On examination the patient was a well developed and nourished white woman who apparently was in great pain. Her skin and mucous membranes were pale. Her temperature was 98°F. and the pulse rate was 110. It was somewhat thin but regular. The systolic blood pressure was 98 and the diastolic 70.

The abdomen was markedly tender across

both lower quadrants. The tenderness was most intense on the left side. There was rigidity in both of these areas and rebound tenderness was present throughout the entire lower half of the abdomen. No masses were felt.

Pelvic examination revealed the perineum to be firm and the bladder in good position. The cervix was softer than normal. The uterus was slightly enlarged, symmetric and anterior in position. There was an extremely tender, fixed mass about 8 cm. in diameter in the left adnexa. There was thickening and tenderness in the region of the right fallopian tube but no mass was palpated. The mass in the left adnexa extended downward toward the cul-de-sac, which was also extremely tender.

A diagnosis of ruptured left ectopic tubal gestation was made and laparotomy was performed at once.

The abdomen was opened through a low midline incision. A large amount of blood and old blood clots were found throughout the abdominal cavity. The larger clots in the region of the pelvis were scooped out so as to visualize the pelvic structures. It was then found that the left fallopian tube was markedly enlarged, being about 3 cm. in width at the point of its greatest diameter. This tube had ruptured at the site of the purplish red swelling and the patient was bleeding actively from the 2 cm. opening. The left ovary was normal so it was not disturbed. The left mesosalpinx was clamped, cut and ligated. The left fallopian tube was excised from the cornu of the uterus and the resulting defect closed with a continuous chromic atraumatic® suture.

The uterus was enlarged to the size of a six-week pregnancy. It was symmetric in outline and rather soft. In order to cover all raw surfaces at the left cornu of the uterus and to give the uterus support on the left side, the left round ligament was grasped a short distance from the uterus, brought behind the uterus and sutured there with interrupted atraumatic silk sutures.

With all bleeding controlled and the patient in good condition, the right fallopian tube was examined. It was found to be enlarged throughout, but in addition it had a knob-like swelling 2½ cm. in diameter in its distal third. The whole tube was purplish red in color, suggesting the presence of retained blood. The end of this tube appeared to be sealed. It was believed that a right hematosalpinx was present. Because the end was sealed and the other tube had been removed, it was thought that this patient could not become pregnant. Consequently it was decided to perform a plastic operation on the fimbriated end of the right tube if the tube was patent in its other portions. In order to find the opening into the lumen of the tube, the sealed fimbriated end was carefully opened. When this was done, a large amount of bright red blood, as well as old dark blood, exuded from the end of the right fallopian tube. This blood washed out a mass of yellowish grey, sponge-like material, suggesting the presence of placental tissue in this tube. Although it was realized that a hematosalpinx is not uncommon on the side opposite an ectopic tubal pregnancy, it was believed that bilateral tubal gestation was present in this instance. In addition, there was excessive bright red bleeding from the fimbriated end of the right fallopian tube which could not be controlled. For these reasons it was believed necessary to perform bilateral salpingectomy. The tube on the right side was removed in the same manner as that on the left. The right ovary contained a corpus luteum but was otherwise normal, so it was not removed. The uterus was supported by the round ligament on the right side by the same method as that used on the left. After all free blood in the pelvis was aspirated, the wound was closed in layers in the usual manner.

A unit of blood had been started prior to the operation and another unit of 500 cc. was given during the course of the procedure. The patient had an uneventful convalescence and made a complete recovery.

Pathologic examination of the tissue removed revealed the following:

Macroscopically, the specimen consisted of two thickened, dilated fallopian tubes, dull brown in color. The left tube measured 8 cm. in length and 3 cm. in diameter at its greatest width. It contained an opening in its midportion 2 cm. in size. The lumen was lined by soft, shaggy, grey material and contained a soft, spongy, fluffy mass. There were two separate masses of this same material, measuring 3 and 4 cm. in diameter, respectively. The fimbriated end of the left tube was closed.

The intact or right fallopian tube measured 7 cm. in length and varied from 1.5 to 3 cm. in diameter. The fimbriated end of the right tube had a recently made opening 5 mm. in

diameter. The lumen contained soft, spongy, grey material and a 1½ cm. fetus.

Microscopically, both fallopian tubes showed the same changes containing decidua and chorionic villi. They were apparently in the same stage of development. The mucosa of both tubes was prominent but matted, giving a cribriform appearance. The fluffy masses were composed of chorionic villi.

The pathologic diagnosis was simultaneous bilateral tubal pregnancy.

COMMENT

In many instances the diagnosis of one-sided ectopic tubal gestation is not difficult. However, there are usually no pathognomonic indications that both tubes are involved. The diagnosis in the instance reported was established at the time of operation. The left tube was ruptured and active bleeding was present. Placental tissue and possibly the fetus were extruded from the opening in the left tube. Bilateral tubal pregnancy was not suspected early in the course of the operation. The diagnosis was made only because the right tube was inspected at the conclusion of the operation. Since the patient's condition was good, this was done to determine the condition of the opposite tube in relation to future pregnancies.

If there is a correctable defect in the remaining tube, this can be accomplished at the same operation if the patient's condition will permit. Numerous pregnancies with subsequent delivery of normal children have been accomplished by these plastic procedures. The discovery of bilateral ectopic gestation under the circumstances described emphasized the importance of always investigating the condition of the tube which has not been involved by an ectopic pregnancy. It is evident that it is extremely hazardous to leave a tubal pregnancy on the opposite side. Subsequent rupture of this ectopic pregnancy is to be expected during convalescence or several weeks later. Clow[36] reports an instance in which both tubes ruptured but apparently two weeks apart. There are factors which play a part in the more rapid development of a pregnancy in one tube over that in the other. In this regard the location of the pregnancy in the tube is of importance. In addition, Behney and Hanes[37] make a point of successive coexistent tubal pregnancies.

When removing the tube for ectopic gestation it is essential that the entire tube be removed. This is shown by the fact that there are numerous instances in the literature of recurrent tubal pregnancy when only a part of the organ had been resected. However, no hard and fast rules can be laid down. When the patient is in early married life and has no children, one may be justified in trying various types of plastic procedures on the remaining tube. The high incidence of ectopic gestation under such circumstances must be assumed. On the other hand, when the patient is older and has children, there is less justification for conservatism.

SUMMARY

Bilateral simultaneous tubal pregnancy is a rare condition. When the case described herein is added to the 109 instances found in the literature, there is a total of 110 instances reported through the year 1954. Emphasis is placed on the importance of always investigating the condition of the opposite tube which has not been involved by ectopic pregnancy. There is justification for being conservative and performing plastic operations on the remaining tube in some patients.

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Tuberculous Appendicitis

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Our interest in tuberculous appendicitis was stimulated when a case was encountered which manifested itself in a rather unusual form. No mention of similar cases was found in the literature.

Incidence. The incidence of tuberculous appendicitis in all appendectomies performed in general hospitals varies from 0.1 to 3.0 per cent.[4,6,7,9,13,19,20,22] The majority of these patients were without known tuberculosis.

The incidence among patients with known tuberculosis ranges from 1.5 to 30 per cent.[3,5,10,13,14,17,18] Figures gathered from necropsy studies of tuberculous patients reveal the appendix to be involved approximately 30 per cent of the time.[8,9] Although there may be wide variations in the age incidence, tuberculous appendicitis is usually a disease of fairly young adults, the average age being about thirty. Most authors state that there is a slightly greater incidence among men than women. Table 1 lists all surgical cases of tuberculous appendicitis recorded up to the present time, including Corbin's first case report in 1837.[1]

Pathogenesis. The mode of infection of the appendix by the tubercle bacillus may occur in one of three ways: (1) hematogenous; (2) by infected intestinal contents (either ingested infected food or aspirated infected sputum); (3) by extension from ileocecal or genital tuberculosis.

There is a considerable difference of opinion as to the most common method of infection. Based on histologic studies of seventeen cases, Jaffe[20] believes the hematogenous route is the usual way. Others[7,13,22] believe infection most often takes place via infected intestinal contents; still other equally competent observers[6,19] favor the third mode of infection.

Primary tuberculous appendicitis: The finding of a tuberculous infection of the appendix with no detectable focus elsewhere is extremely rare, although a number of cases have been reported.[6,10,12,16,20,21,23] Technically, such a diagnosis would have to wait upon thorough postmortem examination. Clinically, it is probably warranted if careful inspection of the abdomen at laparotomy and follow-up studies of the patient fail to reveal tuberculosis anywhere else. It has been suggested that the most likely mode of infection in these cases[23] is the ingestion of food such as cheese, butter or milk which is contaminated with tubercle bacilli. Bacteriologic study of the stools in such cases is indicated.

Table 1*

Author and Year of Report	New Cases	Report of Other Cases
Muller[2] (1910)	6	60
Kinghorn[3] (1916)	7	..
Scott[4] (1917)	1	2
Sleffens[5] (1933)	2	..
Koster and Kasman[6] (1934)	4	31
Drissen and Zollinger[7] (1935)	16	..
Carson[8] (1936)	1	..
Thieme[10] (1937)	13	..
Littlehales[11] (1938)	1	..
Harries and Williams[12] (1938)	1	..
Card[13] (1939)	8	..
Shields[14] (1939)	24	..
Kornblith[15] (1940)	1	..
Kini[16] (1942)	1	..
Osius[17] (1948)	31	..
Jakob[18] (1949)	11	..
Braasted et al.[19] (1950)	21	..
Jaffe[20] (1951)	17	..
Larkowski and Rosanova[21] (1951)	1	..
Coletti[22] (1951)	1	..
Morrison et al.[23] (1952)	4	..

* Total number of cases reported through 1954 is 265.

Pathology. Grossly, the appearance of the appendix may vary from that of the normal to that seen in acute pyogenic appendicitis. Occasionally tubercles or caseation may be noted on the gross specimen.

Excluding appendixes involved in miliary tuberculosis, these appendixes are usually described as being of the ulcerative or hyperplastic types, the former being by far the more common.

On microscopic examination of the ulcerative

type the greatest involvement is seen in the mucosa and submucosa, with caseation, tubercles and ulcerations. Secondary infection of the ulcerations is very common and often leads to the formation of large intramural abscesses with subsequent perforation. There is usually no healing tendency as would be indicated by fibrosis and calcification.

The hyperplastic appendix shows marked connective tissue proliferation and lymphoid infiltration in the muscularis, without caseation or ulceration, and with little or no involvement of the mucosa and submucosa.[6]

Not included in this discussion are those cases of tuberculous periappendicitis in which the lesions are limited to the serosa and are usually secondary to tuberculous peritonitis or salpingitis. In agreement with most other observers, we do not believe these to be instances of true tuberculous appendicitis.

Clinical Picture. Tuberculous appendicitis may manifest itself as an acute or chronic disease. It may also remain in a latent or asymptomatic form. The chronic form is more common than the acute form, with the symptomatology consisting of attacks of low grade pain in the right lower quadrant of the abdomen, vomiting and diarrhea. There is usually a history of pulmonary tuberculosis and the patient is in a state of poor nutrition. During the attacks there will be fever, some localized tenderness and rigidity, and a mass may be palpable. The patient may have been experiencing these attacks for several years. These attacks are due to mild secondary infection of the tuberculous ulcerations which the body is usually able to overcome.

Unless the condition is diagnosed and treated, however, an acute episode will eventually appear. This form is indistinguishable from the ordinary suppurative appendicitis and is due to a severe pyogenic infection superimposed on the tuberculous appendix. Sometimes the acute form of this disease will appear with no previous history suggestive of tuberculous appendicitis.

The latent or asymptomatic form is discovered in appendixes removed routinely in the course of some other abdominal operation. It is probably very common when one compares the frequency of tuberculous appendixes found in tuberculous patients at necropsy (30 per cent[3,9]) with the relatively small number of surgical cases thus far reported.

In some women the signs and symptoms of genital tuberculosis may overshadow complaints or findings referable to the appendix, which may be found secondarily involved at laparotomy. The incidence of true tuberculous appendicitis in pelvic tuberculosis is not known. Brown et al.[24] found a 2 per cent involvement in mild cases of pelvic tuberculosis, but appendectomies were not performed in the more extensive cases.

Correlations between the status of the pulmonary infection and the nature of the appendicitis have been suggested. Card[13] noted that his cases of tuberculous appendicitis occurred in the quiescent phase of the pulmonary disease. On the other hand, Thieme[10] believed that in controlled cases of pulmonary tuberculosis, appendicitis was usually not tuberculous. There is little clinical value in such speculations.

Laboratory Findings. These are not of special significance. The white blood count varies with the form of the disease. In the chronic type it is usually not over 11,000; in the acute form, with superimposed pyogenic infection, it may go up to 20,000. Chest x-rays may reveal hitherto unsuspected tuberculosis but are rarely taken when the disease is in the acute form. Sputum examinations likewise are rarely performed.

Treatment. In 1916 Kinghorn[3] reported forty-three cases of appendicitis among tuberculous patients, fifteen of whom recovered without operation. Accepting his diagnoses, it would be difficult to justify his treatment in the present era of refined anesthetic technics and antituberculosis drugs. When a diagnosis of appendicitis is made, the treatment is appendectomy regardless of the suspected etiology.

At laparotomy it has been the practice to remove other infected viscera, e.g., intestines and fallopian tubes. The antituberculosis drugs may alter this concept when more cases have been studied.

Postoperatively the patients receive penicillin and streptomycin. If the tuberculous process was limited to the appendix, treatment is not continued after the patient has been discharged from the hospital.

Prognosis. The prognosis depends upon the extent of the tuberculosis elsewhere in the body. If the appendicitis is of the primary type, surgery should effect a cure, with the reservation that the patient be carefully

watched for the development of a detectable lesion in another region.

CASE REPORT

A. C. (No. 18430), a twenty-six year old Negro woman, was admitted to the hospital on October 21, 1953. She complained of having pain in the lower abdomen, especially the right lower quadrant, for the past month.

A tumor of the right breast had been removed in 1943. In October, 1952, the patient had been hospitalized because of pulmonary tuberculosis. In June, 1953, she left on an emergency pass and never returned. She stated that her tuberculosis was arrested and had not required chemotherapy.

The patient (gravida II, para II) had had two normal deliveries, the last in September, 1952. It was at this time that the pulmonary tuberculosis was first detected.

Menarche had occurred when the patient was thirteen years of age. Menses occurred every twenty-eight days and were of four days' duration. The last menstrual period began on the day of the patient's present admission to the hospital. There was no history of menometrorrhagia, dysmenorrhea, amenorrhea or any abnormal vaginal discharge.

Physical examination showed a well developed and well nourished young Negro woman in no acute distress. Her temperature was 102°F., blood pressure 130/90 and pulse 110. Positive findings consisted of tenderness but no rigidity in the right lower quadrant of the abdomen, and the presence of a tender cystic mass about 12 cm. in diameter in the right vaginal fornix.

Laboratory studies revealed the following: sedimentation rate 24 mm. in twenty minutes; white blood count 14,050, with 80 per cent polymorphonuclear leukocytes, 17 per cent lymphocytes and 3 per cent monocytes; red blood count 2,970,000, and hemoglobin 62 per cent. Urinalysis and routine blood chemistries were normal.

A diagnosis of right tubo-ovarian abscess, possibly of tuberculous origin, was made and the patient was given 0.5 gm. streptomycin and 600,000 units penicillin twice a day. Chest x-rays of the abdomen were negative.

The patient ran a spiking temperature which fluctuated between 99° and 102.6°F. After ten days the penicillin was discontinued and 250 mg. terramycin were given four times a day for three weeks.

Subjectively the patient was always comfortable, and the temperature and sedimentation rate gradually fell to normal limits. Sputum and gastric examinations were negative for tubercle bacilli. Endometrial biopsy on November 13th revealed a normal proliferative endometrium. Subsequent chest x-rays did not demonstrate any active tuberculosis.

Weekly pelvic examinations revealed little change in the mass first described. On December 8th, after seven weeks of continuous streptomycin therapy, the patient underwent laparotomy. At operation the uterus, tubes and ovaries appeared normal. There was an appendiceal abscess containing some pus and a gangrenous appendix with its tip missing. This abscess was walled off by the cecum, the posterior leaf of the right broad ligament and the small intestines. Appendectomy was performed and the abdomen was closed in layers, with a Penrose drain placed subcutaneously.

Postoperatively the patient was given streptomycin and penicillin.

The pathologic report was as follows: Grossly, the distal end of the appendix was reddish brown and contained a perforation extending into the lumen; there was sanguineous and mucopurulent material in the lumen.

Microscopically, in one section the mucosa of the appendix showed the presence of at least two tubercles consisting of epithelioid cells and several Langhans' giant cells. No caseation was noted. The tubercles were located in the zone of the lymphoid tissue outside the germinal follicles. A small, corrugated hyaline scar was present ½ microscopic field away from the larger tubercle. (Figs. 1 and 2.)

The mucosa showed marked infiltration with plasma cells and a moderate number of eosinophils. The lumen contained mucus, desquamated epithelium, some polymorphonuclear leukocytes and red cells.

In another section several epithelial tubercles were present in the outer muscular layer. The overlying serosa was thickened and showed small extravasations of blood and collections of lymphocytes within dilated lymphatics. The submucosa and mucosa showed considerable hemorrhage. There were accumulations of polymorphonuclear leukocytes within the hem-

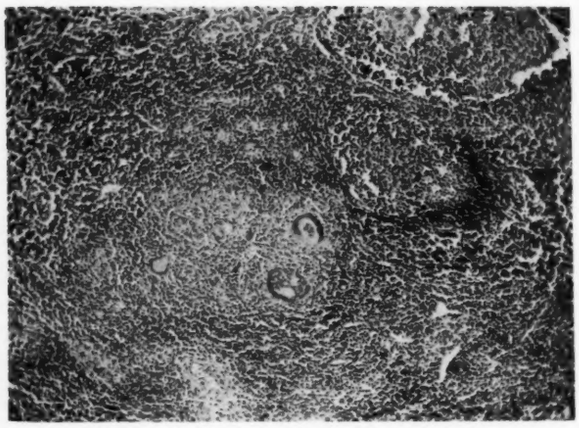

FIG. 1. Mucosa of appendix showing a tubercle with giant cell formation. Original magnification, × 100.

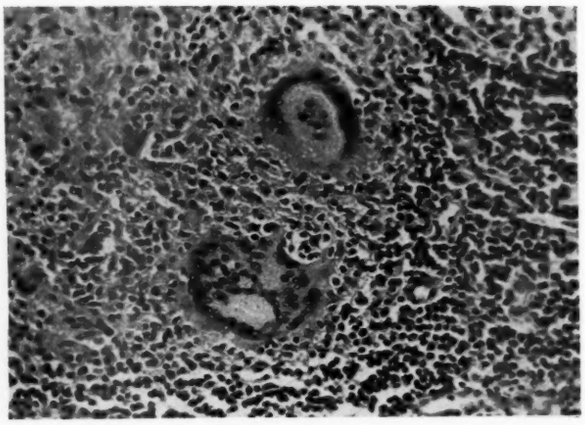

FIG. 2. Higher magnification of Figure 1 showing giant cells made up of epithelioid cells. Original magnification, × 210.

orrhagic areas, with loss of surface epithelium in these areas.

Except for the small hyaline scar, there was no evidence of either healing or caseation.

Diagnosis was acute gangrenous perforated appendicitis and chronic tuberculous appendicitis. On receipt of this report the patient was given para-aminosalicylic acid (PAS) and isoniazid (INH®) in addition to the streptomycin.

Endometrial biopsy was repeated on December 22nd and again failed to reveal any evidence of tuberculosis. The patient was discharged on the fourteenth postoperative day and referred to the Chest and Gynecologic Clinics.

She became pregnant several months after discharge, her last menstrual period being February 27, 1954. Because of cervical erosion with slight bleeding, a cervical biopsy specimen was taken on July 14th. This showed only chronic cervicitis. Her antepartum course was otherwise uneventful and on December 4th she was delivered of a live, full-term infant. Her postpartum course was normal and she was discharged on December 10th.

COMMENTS

This case illustrates a point of which the physician should always be cognizant: a right-sided inflammatory pelvic mass associated with negative findings in the remainder of the pelvis is strongly suggestive of an appendiceal abscess. In this particular case, because of the position of the mass and the history of pulmonary tuberculosis, it was assumed that we were probably dealing with a tuberculous tubo-ovarian abscess. Numerous unsuccessful efforts were made preoperatively to substantiate this diagnosis, while the true nature of the pathologic condition was overlooked. The normal uterus and left adnexa should have alerted us to the possibility of an appendiceal abscess.

In addition, tuberculous appendicitis probably occurs more frequently than pelvic tuberculosis in patients with pulmonary tuberculosis. This statement is based on autopsy findings cited heretofore[8,9] and the work of Auerbach,[25] who found the incidence of pelvic tuberculosis in such patients to be only 9.1 per cent.

We believe that as pulmonary tuberculosis becomes better controlled, the incidence of tuberculous appendicitis will rise. As the patients are kept alive for longer periods, the chances for the appendix (as well as other organs) to become involved increase. Once this has happened, we do not believe that the antituberculosis drugs can alter the clinicopathologic pattern thereby set up—tuberculous ulceration of the mucosa, secondary infection and abscess formation, with the accompanying signs and symptoms.

SUMMARY AND CONCLUSIONS

1. The literature on tuberculous appendicitis has been reviewed. Two hundred sixty-five cases were found to have been reported in the literature.

2. The various theories of pathogenesis and a correlation between the pathologic and clinical picture have been given.

3. A case of tuberculous appendicitis misdiagnosed as a tuberculous tubo-ovarian abscess has been presented. A right-sided pelvic in-

flammatory mass with negative findings elsewhere in the pelvis should suggest an appendiceal abscess.

4. The treatment of tuberculous appendicitis, as with the ordinary suppurative appendicitis, is surgery.

Acknowledgment: We wish to thank Dr. Vera B. Dolgopol, Pathologist at the Harlem Hospital, New York, N. Y. for the description of the specimen.

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Successful Treatment of Postlumbar Puncture Headaches

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Effective therapy for the distressing complication of spinal anesthesia, postlumbar puncture headache, has long taxed the armamentarium of the anesthesiologist. Early in 1950, Rice and Dabbs[1] reported relieving postlumbar puncture headaches in twenty-two patients by instilling saline into the peridural space by means of indwelling catheters. It occurred to one of the authors that if similar results could be accomplished by single injections of saline into the caudal canal, a simple, safe method of therapy would be available. The results of four years' investigation of this possibility comprise this report.

Table 1
THERAPY OF POSTLUMBAR PUNCTURE HEADACHES WITH SINGLE INJECTIONS OF SALINE IN THE CAUDAL CANAL (243 PATIENTS)

Results	No. of Patients	Per cent
Complete relief	154	71.2
One reblock with complete relief	19	
Marked relief ("almost complete")	31	12.7
Moderate relief	21	10.7
One reblock with moderate relief	5	
No relief	10	5.3
One reblock with no relief	3	
Moderate to complete relief	229	94.6

Criteria for Selection of Patients. Patients with cephalalgia who were referred to our Nerve Block Clinic were carefully evaluated to ascertain, if possible, the etiology of their headache. Only those patients who demonstrated the following criteria were selected for this therapeutic trial: (1) a history of spinal anesthesia or a diagnostic lumbar puncture one to four days prior to the onset of the headache; (2) a *severe* headache limited to the occipital or frontal regions, or both, with or without nuchal discomfort; and (3) complete relief or marked improvement of the headache when the recumbent position was assumed. (Almost all of these patients were confined to bedrest because of their headache.)

Method. The patient was placed in the prone or lateral position, and a 20 gauge spinal needle was inserted through a procaine skin wheal into the caudal canal. Sterile physiologic saline was then injected slowly into the caudal canal until the patient reported a sensation of pressure in the posterior thighs, or a sensation of girdle constriction of the trunk. This was assumed to indicate that the caudal canal had been filled with solution which was producing pressure on the lower lumbar and sacral nerves. The needle was then withdrawn and the patient was placed in the sitting position and kept there for at least thirty minutes. Following this, the patient was returned to the ward and permitted as complete ambulation as was consistent with the postsurgical requirements.

On occasions when the caudal canal was not accessible, the lumbar route was used to reach the epidural space.

The blocks were completed by members of the Anesthesia Department, primarily residents in various stages of their training.

Results. Two hundred forty-three patients received either caudal or epidural blocks with saline for their postlumbar puncture headaches. The results are tabulated in Table 1. Complete relief of the headache was secured in 173 patients (71.2 per cent). Of these, nineteen patients (7.8 per cent) required a second block the following day for permanent relief. An additional thirty-one patients (12.7 per cent) obtained "almost complete" relief, that is, the headache was not 100 per cent relieved, but

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almost so. These patients tolerated an erect position without difficulty. Twenty-six patients (10.7 per cent) reported moderate relief, that is, the headache was still present, but tolerable. Only thirteen patients (5.3 per cent) reported no relief.

The symptom of nuchal stiffness or soreness was unrelieved in any case in which it was present even though the typical headache was completely eradicated.

The volume of saline solution injected varied from 10 to 120 cc. The majority of patients received 30 to 50 cc.

There were no complications associated with the therapeutic procedure.

COMMENTS

No attempt was made in this study to prove or disprove the leakage theory as the cause of postlumbar puncture headaches. An attempt was made solely to relieve the symptoms when present. It is still quite remarkable to observe that these severe headaches are usually completely relieved immediately following the block. Many patients were very reluctant to assume the sitting position, and were equally amazed to find that their headache was no longer present. Those few patients whose headaches recurred, requiring a second block, almost always reported that their headache was not as severe as it had been prior to the first injection.

The caudal approach is preferred to the lumbar epidural route because, technically, there is less likelihood of repuncturing the dura.

SUMMARY

Two hundred forty-three patients with severe postlumbar puncture headaches were treated with caudal or epidural injections of normal saline. The therapy was successful in relieving headache in 204 patients. Moderate relief was obtained in twenty-six patients. In thirteen patients symptoms were not affected.

CONCLUSION

Caudal instillation of saline is a simple, safe and effective means of eradicating postlumbar puncture headaches.

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Surgical Treatment of Chronic Ulcers of the Leg

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ULCERS occur in any part of the body, but the readiness with which they heal in all regions except the lower extremities focuses particular attention to the leg. Several factors are responsible for their occurrence, namely, upright posture producing gravitational stasis in the blood vessels of the lower extremities, the mass of tissue not paralleled in blood supply in the rest of the body, and the fact that lymphatic drainage is into the same vessels as the pelvis and rectum.

This discussion is devoted to the various types of chronic ulcers of the leg. The purpose is to emphasize radical therapy and to describe the technic employed by the authors.

PATHOGENESIS

An ulcer is a loss of substance caused by death of the superficial structures, the floor consisting of granulation tissue and corresponding to the wall of an abscess. An ulcer may increase in size by death of adjacent structures or by sloughing. In an ulcer the corium is always destroyed and generally the subcutaneous tissue, resulting in a scar on healing, which is by granulation. The embryonic tissue vascularizes and becomes granulation tissue, which is converted into fibrous tissue. The fibrous tissue contracts and, strongly pulling the edges of the ulcer together, lessens the size of the cavity. When granulations reach the level of the skin, epithelium at the edges of the ulcer proliferates and the lesion is covered over with new epithelium.

A long period is usually required for spontaneous epithelization of ulcers of any appreciable size. The final epithelium which covers the surface, when it does, is a thin covering devoid of hair and glands and without much derma. This delicate covering, especially when over a bony prominence, is susceptible to the slightest injury or infection; even a very light blow will cause it to break down and ulcerate.

Ulcers are classified according to their condition and the associated constitutional state of the patient: (1) varicose, hemorrhagic, neuralgic and arteriosclerotic; and (2) tuberculous, syphilitic and nutritional. Conditions such as great pain, hemorrhage, edema, exuberant granulations, phagedena, sloughing and eczema are looked upon as complications.

The condition of local tissue in long-standing ulcers is the same, regardless of the original disorder. The ulcer shows a pale necrotic base and hard indurated margins. Long-standing ulcers often penetrate to the deep fascia and sometimes cause periostitis of the tibia or fibula.

Indurated areas about the ulcer and a hard indurated base indicate a barrier of dense avascular scar tissue, which interferes with the blood supply of the ulcerated areas. The pathologic condition of the discolored indurated areas surrounding the ulcer is similar to that of the ulcer base. Changes include obliterative endarteritis, as well as chronic phlebitis, in the vessels of the area, dense scar tissue formation and degrees of calcification in soft tissue. (Fig. 1.)

In deep chronic phlebitis of the leg there is frequently considerable swelling. At first the edema is pitting; later it becomes irreversible, frequently associated with calcium deposits or ossification inside the dense fibrotic subcutaneous tissue. The valves of the veins are destroyed, and the lumens of the femoral and perforant veins become partially obstructed, their walls thickened and not amenable to the pumping action of the leg muscles.

CHARACTERISTICS OF CHRONIC LEG ULCERS

A chronic leg ulcer may be chronic from the onset, or may result from an acute ulcer. It is usually a solitary lesion, 2 inches above the internal malleolus. Syphilitic ulcers often occur in groups, are usually crescentic and are frequent on the front of the knee. Tuberculous ulcers, as a rule, are covered with pale edematous granulations, signifying a tendency to venous stasis. Edges of tuberculous ulcers are undermined and irregular, the surrounding area livid and tender, and the discharge thin and scanty. An ordinary chronic ulcer is circular or oval and surrounded by congested, discolored and indurated skin.

The floor of the ordinary ulcer is uneven and covered with granulations, each of which is red and the size of a pinpoint, and which may be exuberant or edematous. If granulations are absent, the ulcer has the appearance of a piece of liver, or is smooth and glazed. Edges are thick, turned out and not sensitive to touch; occasionally, but rarely, they are thin and undermined. Some ulcers are indurated and adherent. This adhesion to the deeper structures prevents healing by antagonistic contractions. In addition, an ulcer may fail to heal because of severe infection, want of rest, absence of granulations resulting from deficient blood supply, edematous and exuberant granulations, or because of some constitutional disease.

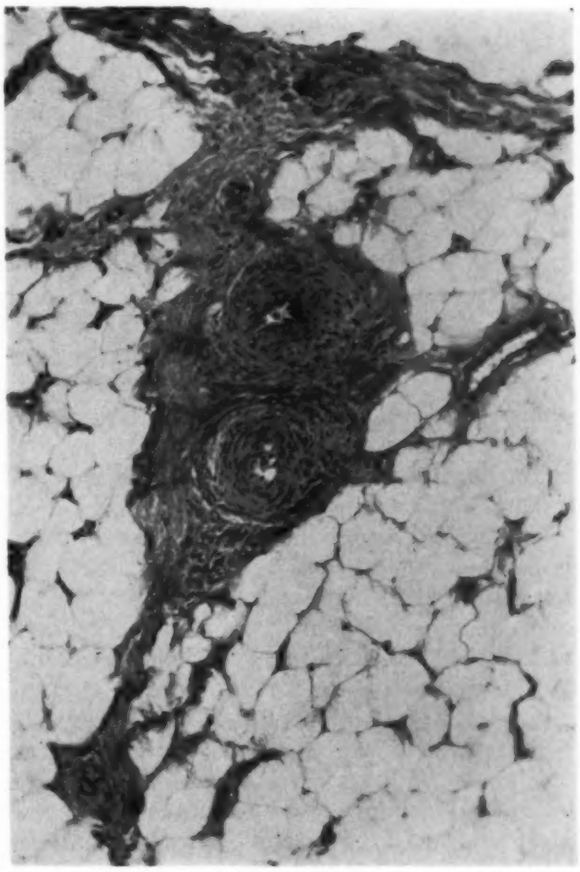

FIG. 1. Arteriosclerosis (high power field).

MORBID CONDITIONS

In ulcers of the leg numerous associated morbid conditions occur which are dependent upon the venous stasis, blood stagnation and resulting local anoxemia, accumulation of toxic metabolites and tissue acidosis. Associated skin changes are perhaps the most striking. Eczematous dermatitis is a common result; it may be localized or may involve the whole of the ulcer-bearing area of the leg, i.e., from below the malleolus and the junction of the middle and upper third of the calf. Pigmentation occurs in the form of brownish maculae which coalesce to form large areas of discoloration, and which may ultimately occupy the entire ulcer-bearing area. Pruritus is common, and artefact dermatitis may result from scratching.

Other results are alopecia and a dry and hypertrophied skin. Edema of the ankles and lower part of the leg occurs in advanced cases. In addition, a brawny swelling of the limb is sometimes seen, owing to hypertrophy of the subcutaneous and deeper areolar tissues caused by lymph stasis. An interesting result of the local hyperemia, to which attention has only recently been drawn, is decalcification of the lower parts of the leg bones.

ETIOLOGY

The etiology of leg ulcers is important inasmuch as knowledge of the cause forms a basis for prognosis. There is a tendency to attribute all ulcers of the leg to varices. In the experience of the authors, however, varicose ulcers, *per se*, are the least common, and those ulcers generally termed varicose have often been found to be due to one of the many various etiologic factors. The more common of these are: (1) deficiencies of the arterial blood supply, (2) tumors, (3) periostitis and osteomyelitis, (4) trauma, (5) varicosities and their sequelae, (6) diffuse fibrosis, (7) syphilitic and tuber-

culous infections, (8) neurogenic disorders and (9) nutritional disturbances.

On the other hand, Cokkinis,[1] in a report of 144 cases of indolent ulcer, found ninety (62.5 per cent) to be associated with varicose veins. Zimmerman and Faller[2] believe that the term phlebitic or postphlebitic ulcer is the most appropriate term, because in their opinion, the vast majority of leg ulcers are related to disturbances of venous circulation. They agree that neoplastic and traumatic ulcers do exist, but they believe that those caused by varicosities are the most familiar.

Conversely, Brown et al.,[3] in a large series of leg ulcers considered not amenable to conservative treatment, found that varicose veins did not enter into the etiology.

Anning[4] emphasized the role of deep thrombophlebitis in the cause of leg ulcer. Its major importance is tacitly accepted by most writers on the subject. Birger,[5] studied material from the Swedish Pension Board and concluded that as a cause of incapacity, deep thrombophlebitis supersedes such important disease groups as tuberculosis of the bone and joint, and diabetes.

The amount of invalidism caused by chronic leg ulcer was investigated by Jorpes[6] in Sweden. He found that the disability caused annually by thrombosis of the leg alone was more severe than the sequelae arising in people surviving motor car accidents.

With the aid of phlebography, Bauer[7] was able to demonstrate that in 90 per cent of all patients acute thrombosis began in the deep vein trunks of the calf and if not adequately treated, generally progressed in the direction of the blood stream: first to the popliteal, then to the superficial femoral vein. The lumens of these vessels became completely closed (up to the thrombotic masses) and the blood returning from the lower leg was forced to use accessory channels.

In 1942 Bauer[8] also found that during the first year following an attack of thrombosis, the great saphenous vein and its tributaries served well as an outflow system and that stasis symptoms in the lower leg were not pronounced. However, phlebograms obtained five to ten years after the acute attack showed evidence of degeneration and varicosity of this subcutaneous vein and, probably as a result of this, there were marked skin changes in the form of induration and ulcers in many of these patients. Bauer stated that the femoral vein at this stage either remained closed or showed signs of partial recanalization, but in no case had the vein reassumed its proper function.

Bauer,[9] in 1946, stated that 80 to 90 per cent of these lesions, generally thought to be varices, were caused instead by an earlier deep thrombosis.

According to White and Smithwick,[10] chronic ulceration of the lower extremities may be associated with vasospasm, because in most cases the patient has previously had increased peripheral sympathetic activity secondary to the local lesion.

Gravelle and O'Donnell[11] reported vasospasm as being associated with ulcers of the lower third of the leg after deep thrombophlebitis, varicose veins or recurrent bouts of cellulitis with subsequent fibrosis. They found that if the circulation could be increased, the extremity was less apt to develop excoriations, and fungus or other infections could be better controlled. According to these authors, the nerve path to the lower extremity for vasomotor and sudomotor impulses is the same, and both are carried over the sympathetic nerves arising from the last thoracic nerves to the second lumbar spinal nerves. With hyperactivity of the sympathetic nervous system, Gravelle and O'Donnell believe that greater constriction of the vessels and more sweating occurs, further lowering the skin temperature. It remains unanswered whether this phenomenon of sweating is entirely caused by sudomotor hyperactivity or increased capillary permeability. As a criterion for lumbar sympathectomy the diagnostic test employed by Gravelle and O'Donnell was satisfactory response to paravertebral procain infiltration of the first to fourth lumbar ganglion. Response was indicated by warm and dry skin, relief of pain and increased arterial pulsations. Of twenty-one patients, their results were good in six ulcers caused by stasis, four arterial ulcers, nine traumatic and one caused by cyanosis and dermatitis, with only one failure, that in a traumatic ulcer.

Atlas,[12] in discussing a modified form of lumbar sympathectomy for leg ulcers, indicated that it is not necessary to excise the first lumbar ganglion to interrupt permanently the sympathetic supply to the lower extremity.

Kinmonth,[13] on the other hand, has laid serious doubt on the validity of the concept of reflex arterial spasm as a cause of leg ulcers.

The results reported by Gravelle and O'Donnell were good, and in the opinion of the present authors, the procedure of lumbar sympathectomy is a satisfactory addition to the armamentarium of ulcer therapy. It is employed by us in selected patients. However, we concur with Kinmonth in his doubt regarding the importance of reflex arterial spasm in the etiology of leg ulcers.

Induration of the leg, a hardness or thickening of the skin and subcutaneous tissues, results from edema. There is usually more than one factor included in the etiology. Mahorner[14] groups these as follows: (1) post-thrombophlebitic edema, (2) varicose veins, (3) obesity, (4) trauma, (5) infection, (6) lymphedema, (7) immersion leg, (8) arteriovenous communications and (9) systemic causes.

TYPES OF LEG ULCERS

The following is a list of the many types of ulcers of the lower extremity:

Indolent ulcer: a necrotizing lesion which shows no tendency to heal

Decubitus ulcer: caused by pressure upon an area of feeble circulation, and in most instances a condition of gangrene

Marjolin's ulcer: an epithelioma arising from a chronic ulcer or old cicatrix

Fungus or exuberant ulcer: produced by interference with venous return from the part

Varicose ulcer: dependent upon varicose veins

Edematous ulcer: may result from impediment of venous return

Neuroparalytic or trophic ulcer: caused by impairment of the trophic nerve fiber or of trophic centers of the cord

Serpiginous ulcer: spoken of as syphilitic lupus, frequent in tertiary syphilis, and particularly common about the knee

Tuberculous ulcer: usually arising secondary to internal tubercular disease

Callus ulcer: the most chronic form of indolent ulcer, sunken deeply below the level of the skin

Phagedenic ulcer: results from profound microbic infection of tissues debilitated by local or constitutional disease, and is commonly venereal.

A description of the histologic pathology of each type of ulcer peculiar to the lower extremity would be too extensive for the scope of the present paper. Clinically, the various types of ulcer of the leg may exist independently, but two or more are not infrequently combined. Likewise, infection may be superimposed upon an existing ulcer.

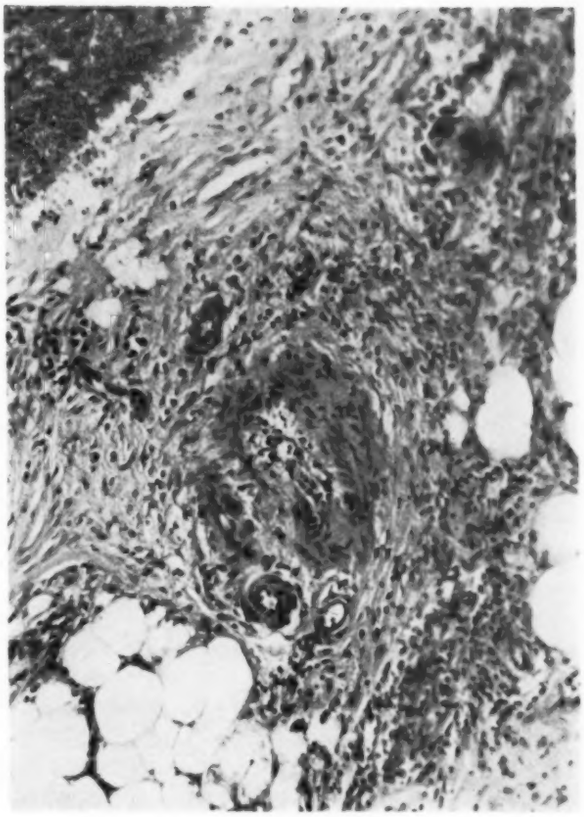

FIG. 2. Arteriosclerosis (low power field).

True varicose ulcer, that caused by perforation of a small venule, is usually very small unless complicated by infection or arteriosclerosis, and heals fairly rapidly with adequate varicose vein therapy. It should be pointed out, however, that although disease of the vein constitutes the initial step in the genesis of these lesions, tissue changes are permanent and irreversible and ulcers may persist or continue to evolve even after complete eradication of the associated varicosities.

In ordinary infectious ulcer, once the virulence of the organism is overcome, healing proceeds rapidly, despite the fact that the area involved may be large. The poorest prognosis is in arteriosclerotic ulcer, such as encountered in old people with definite signs of hardened arteries and very occluded blood vessels.

When there is extensive thrombophlebitis, ulceration is more extensive and healing depends upon the complicating infection and nature of the blood supply. (Fig. 2.)

DIAGNOSIS

In the differential diagnosis of leg ulcers, history taking is of prime importance. An outline such as the following may be a valuable determining guide.

I. Place of residence
   A. Tropics
   B. Subtropics
II. Familial and racial background
III. Other treated or untreated skin lesions
IV. Previous vascular disease
V. Focal or systemic infections
VI. Allergy
   A. Systemic
   B. Topical
VII. Exposure to occupational hazards
VIII. Medications previously administered

Likewise, the pathologic pattern should be the basis for selection of therapeutic measures and procedures, and complete physical examination and laboratory analyses are prerequisites.

Physical examination should include: (1) location of ulcer, its size, shape, adherence, discharge, crusts, base, margins and surrounding areas; (2) pain and anatomically related glands; and (3) cardiac condition, weight in relation to height, arterial bed, venous system, protein and vitamin levels, and thyroid.

Laboratory analyses should include: (1) complete blood count, urinalysis, sedimentation rate, serologic test for syphilis; (2) pathologic and bacteriologic examination of smears and scrapings; (3) roentgen study; and (4) biopsy in certain ulcers.

RADICAL THERAPY

Because large surface defects are best repaired with skin as near normal as possible, treatment is by excision of the ulcer and sclerotic tissue, and replacement by skin grafting. This has been the procedure of choice in recent years. Preparation of the area of operation is important. Care must first be given to any causative factor that is controllable, such as vein stripping. Improvement of circulation and control of infection is next attempted. At the same time as effort is made to get the base of the ulcer clean by bed rest with the leg elevated, and daily change of dressings moistened with saline or boric acid solution. In preparation for a skin graft a period of as long as six weeks may be necessary.

Indications for Free Skin Graft or Pedicle Flap. As a rule, a skin graft can be placed in one operation. In contradistinction, a skin flap will take at least two and often more operative procedures. When sufficient subcutaneous tissue is present, a thick skin graft will stand trauma fairly well, even on the sole of the foot, and obtains a nerve supply sooner than a skin flap. Slowness with which a skin flap obtains a nerve supply may be a detriment over the heel, because of development of trophic ulcers. The skin flap will furnish cover for exposed tendons, nerves and bones, and has the advantage of covering relatively avascular areas.

Resistance of a skin flap to infection is such that with reasonable precaution no difficulty will be encountered. The pedicle, as a rule, should not be twisted. However, a slight twist is often necessary, in which case the pedicle must be loose.

A plaster cast is necessary to hold a cross leg flap and to have proper alignment of the legs and tension on the flap, and must of necessity be applied under direct vision. Any slough, dead tendon, fascia or necrotic bone must be removed, and the base rendered as nearly sterile as possible.

To make direct skin transfer from the calf to leg or foot, the calf flap should be cut in the line of the blood supply with the base upward. When cutting a flap to cover an area on the leg, the base should be as wide and short as possible. On the leg, the flap should always be taken over the muscular area posteriorly or laterally. A free skin graft from the abdomen or thigh is applied over the donor area from which the flap is taken.

The scarred epithelium which covers varicose ulcerations after spontaneous healing under conservative treatment withstands trauma of everyday life in some instances. However, there is always the threat of ulceration as normal vitality of such skin is never entirely present. A certain number of the ulcerations caused by varicose veins fail to heal, in spite of every accepted therapeutic procedure. Many intractable ulcerations of the leg may be healed if the scar is completely excised, and the denuded area covered with a proper skin graft, or when applicable, a skin flap.

The lower leg presents a particular problem

when circumferentially scarred or ulcerated. When there is complete circular loss of skin, spontaneous epithelization is greatly retarded and there may be complete lack of growth from the lower edge. However, with a good bridge of epithelium left throughout the length of the leg, epithelization may occur spontaneously. Deep ulceration over the tibia and the malleolus shows practically no tendency to spontaneous healing. Circumferential scarring tends to constrict the leg and interferes with the free circulation.

If scarring is fairly deep, especially where the tibia, malleolus or Achilles tendon approach the skin, proximity of a more or less bloodless structure practically cuts off the blood from the base of the superimposed soft tissues, and blood supply from the edges is lessened by the circumferential scarring. Microscopically there is some marked activity of the skin edges with excessive keratinization in some, while others show practically no epithelial activity. Because of the dependent position of the lower extremity, the additional factor of lymph stasis enters the picture. All of these factors tend to promote a vicious circle. Repeated trauma causes ulceration which produces more fibrosis and more constricting of blood supply. Occasionally a chronic leg ulcer undergoes malignant degeneration. (Fig. 3.)

Scarred healing over the tibia or ankle may be quite uncomfortable, with a sensation of tightness or pain. When this is present and the lesion is healed, the patient can often be made more comfortable if the scar is split lengthwise to allow relaxation, and the resultant defect is covered with a free skin graft.

Since saucerization for chronic osteomyelitis has been popularized, patients are encountered in whom re-epithelization does not occur because of separation of the superimposed soft tissues and exposure of the bone itself. If the scarred skin does cover bone, the bone is so close to the surface that resistance to trauma is inadequate. The simplest example of such a defect is the gutter remaining in the tibia, caused by removal of the diseased tissue of the anterior and interior portions of the bone. To repair defects of the general type it is necessary to cover the gutter or cavity with a skin flap containing the subcutaneous tissues. A double pedicle flap may be used and the divided area covered with a free skin graft. However, this procedure is limited because of blood supply.

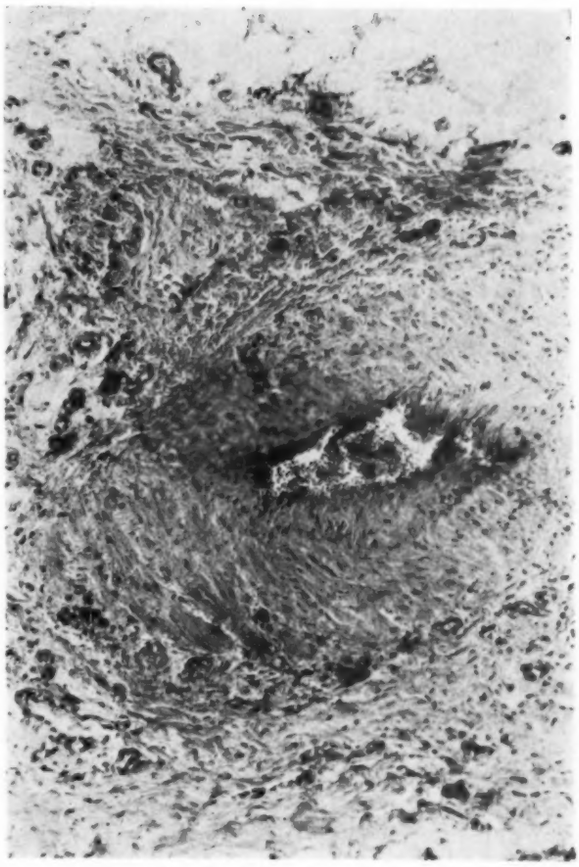

FIG. 3. Thrombophlebitis, showing thrombosis within the vessels.

For areas requiring large flaps, tissue from the opposite leg is usually chosen.

OPERATION

At operation for obtaining both skin flap and skin graft, the ulcer base and surrounding scar are excised. This may involve sacrifice of bone, muscle, nerve or tendon. A free graft of approximately intermediate thickness is cut and basted in the resultant wound. If bone has been sacrificed, the free graft is not expected to take in this area. Nevertheless, it makes an excellent dressing and as granulations form, this area over bone can be grafted at a later period. The wound is dressed at operation with a pressure dressing and the first postoperative dressing is performed in seven to ten days. It has been found that good pliable subcutaneous tissue will develop and the replaced skin will stand the wear and tear of ordinary life.

The rationale of operation is removal of all

dense, avascular scar tissue from the base and periphery of the ulcer, and covering of the defect.

The authors have found it best to perform some of these procedures in more than one stage since extensive resection of scarred skin and fascia is often a shock-producing procedure.

The incision is made into normal skin, completely circumscribing the scarred area, and is carried down through the deep fascia. The circumscribed area is excised by dissection in the deep fascial plane so that only normal, well vascularized tissue remains. This often necessitates carrying the dissection down to muscle, periosteum or bone. If the bone is sclerotic, it is decorticated at this stage until free bleeding occurs. After hemostasis is obtained, the wound is dressed with an ointment dressing of petrolatum-impregnated gauze and pressure dressing, and a plaster of paris cast splint is applied.

If a two-stage procedure is performed, a period of ten to fourteen days is allowed for granulations to form before the skin graft is applied. If a one-stage procedure is employed, a thick split-skin graft for complete coverage is taken from the thigh, hip, back or abdomen, and immediately sutured into place with interrupted or continuous sutures and dressed with petrolatum-impregnated gauze and pressure dressing followed by a plaster of paris cast.

COMMENTS

After differential diagnosis of ulcers of the leg based upon history, physical examination and laboratory studies, the condition of the patient and the underlying pathologic condition should be the criteria in the choice of therapeutic procedure. However, we believe that this point bears repetition. In our opinion, after care has been given to any causative factor that is controllable, the most satisfactory approach in most cases is definitive treatment of leg ulcers *per se*. The procedure we employ is correction of circulation by adequate excision of the entire ulcer, regenerated epithelium and underlying and surrounding scar, down to vascularity, plus the elimination of all contributing factors, followed immediately by a cover of skin to produce healing. Although leg ulcers are often the result of faulty circulation and circulation cannot be improved beyond a certain point, they can be alleviated with the elimination of the local lesion and support.

The chronic skin ulcer is always associated with some degree of infection, and until bacteriostasis is accomplished the ensuing infection will be a deterrent to wound healing. All serum exudates, blood clots and frequent change of dressings, in addition to antibiotics and sulfonamides, bolster the immune processes and eradicate many bacteria. But complete eradication of the ulcer depends upon meticulous surgical care of the wound.

Many preparations have been claimed to eliminate scarring and speed healing when applied topically. However, after careful evaluation and properly kept protocol, we have found these valueless.

SUMMARY

Ulcers peculiar to the lower extremities have been discussed, and types and characteristics of these ulcers presented.

Basis for accurate differential diagnosis of leg ulcers has been outlined.

Etiology of leg ulcers has been discussed, and reports in the literature have been presented which indicate the existing divergence of opinion regarding the cause.

Radical therapy with excision of the ulcer and sclerotic tissue has been emphasized as a definitive method of treatment for ulcers of the leg.

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Klein and Scarborough describe five recent cases of Hirschsprung's disease in the newborn. If diagnosis is delayed, prognosis becomes serious; three of these infants died. Gastrointestinal x-rays will confirm the diagnosis, but the condition should be suspected when abdominal distention, vomiting and scarcity of fecal output coexist. Some patients do well on conservative therapy; but if the "functional obstruction" shows no improvement within a week, Klein and Scarborough recommend surgery. They prefer colostomy, situated just proximal to the aganglionic segment. A few years later this segment can be excised with more safety. Frozen sections should be taken at operation to verify the presence of normal ganglia so that site of resection and restoration of intestinal continuity will be followed by normal colonic function. (*Richard A. Leonardo, M.D.*)

Excessive Compression by "Webril" Padding

LEWIS COZEN, M.D., ROBERT MAZET, JR., M.D. AND D. C. SKILLING, B.S., *Los Angeles, California*

A BANDAGE is now available which has many advantages over sheet wadding. This bandage (called webril®) sticks to itself, molds itself accurately to the bony contours of the extremity and can be applied in many thicknesses over bony prominences, thus obviating the need for felt in these areas. Its ease and smoothness of application under a plaster cast are demonstrable with the first use of this newer cast padding.

There is one disadvantage of webril; it does not slide. Comparative tests at the University of California at the Los Angeles Prosthetic Engineering Laboratories revealed the following (Figs. 1 to 5):

Part I. Strength Tests on Medical Bandages. Two types of medical bandages were submitted to Engineering Research for tensile and creep tests. The samples were: (1) standard type sheet wadding, double layer with cotton filling, 6 inch roll submitted; (2) webril, uniform single layer, 4 inch roll submitted. These samples were tested as submitted to preserve whatever edge condition prevailed.

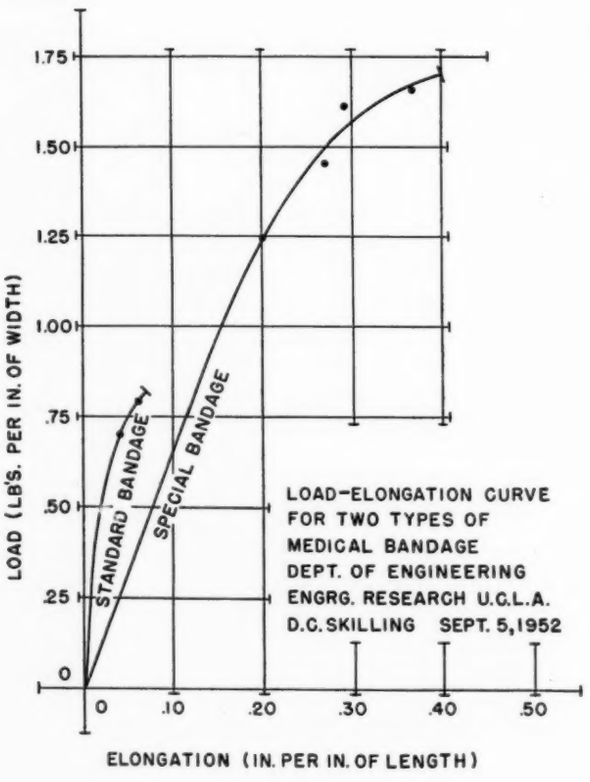

FIG. 1.

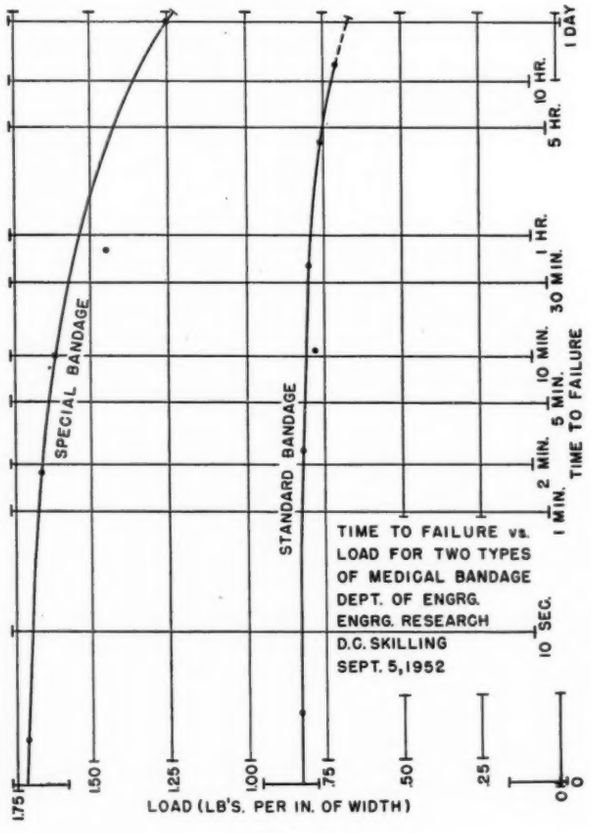

FIG. 2.

Test equipment consisted of a pair of sponge rubber lined clamps designed to grip the specimens uniformly over their full width, and the weights pan and weights used to load the specimens.

The following test procedure was used: The ultimate tensile strength was estimated by pulling one specimen with a spring scale, noting the load at fracture. Static loads of approximately 70 per cent of this value were then slowly applied, noting the initial elongation (3 inch gage length used on all tests) and the time to failure. The loads were then increased until immediate failure obtained.

Plots of load per unit width vs. elongation per unit length and the load per unit width vs. time to failure were made. It was noted that throughout a test run no increase in initial elongation could be noted until just before failure for either type of bandage.

The results showed that the special bandage had twice the ultimate strength of the standard type, with about six times the elongation at

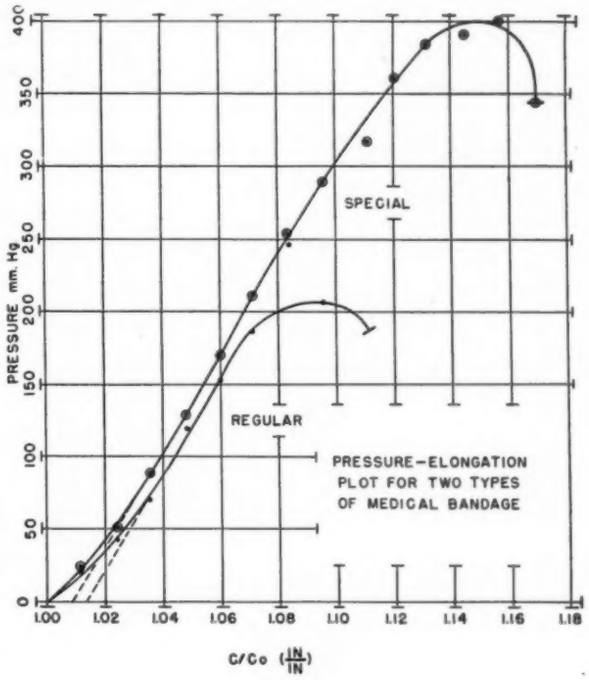

FIG. 3.

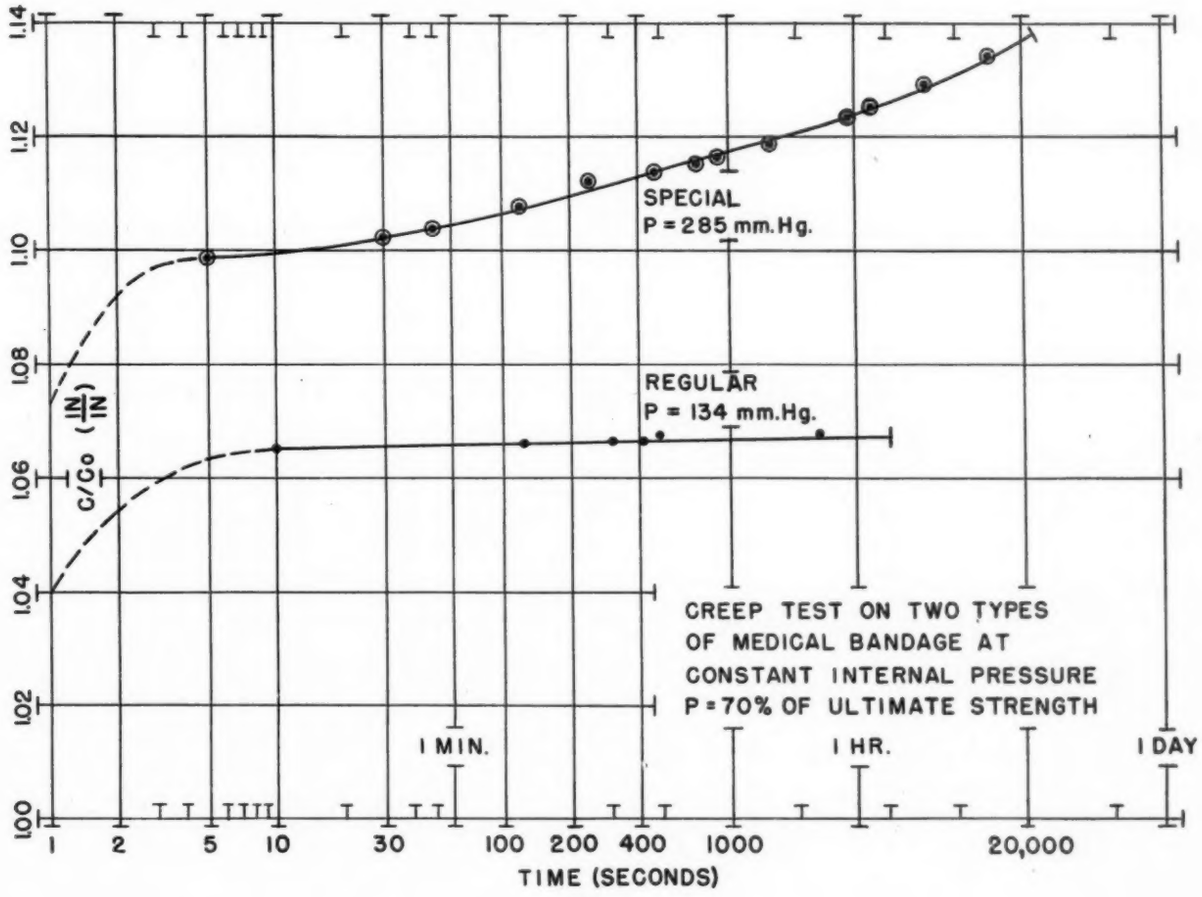

FIG. 4.

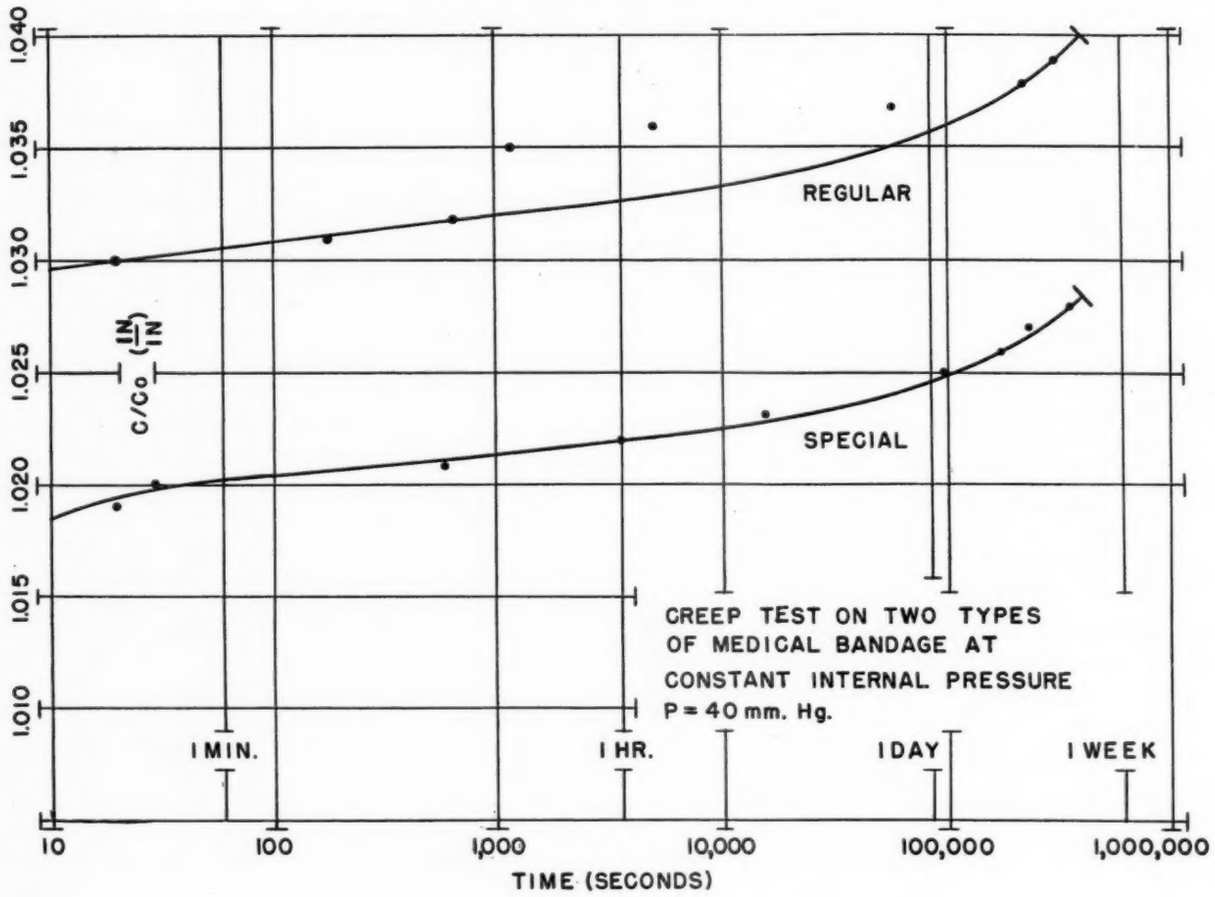

FIG. 5.

failure. There is a margin of error in the results presented as indicated by the tests which did not follow the general trend. However, for a comparison of the two bandages the results are significantly different so as to be well outside the experimental error.

Part II. Cylindric Expansion Tests. These tests were a simulation of a bandage wrapped around an extremity and then subjected to internal expansion as caused by swelling. The bandages tested were: (1) Standard type sheet wadding, double layer cotton filled; (2) webril, uniform single layer. Both bandages were tested in 4 inch widths with three complete wraps about the testing cylinder.

The testing cylinder consisted of a $2\frac{9}{16}$ inch diameter polished stainless steel tube split lengthwise. Linear separation of split cylinder under load was measured with a dial indicator to the nearest thousandth of an inch and loads were measured by means of a strain gage cable tensiometer to the nearest pound.

The test results are shown graphically in terms of the circumference ratio vs. internal pressure in millimeters of mercury. The circumference ratio was derived by means of the following expression:

$$\text{Circumference Ratio} = \frac{C}{C_0} \text{ where } C = C_0 + 2E$$

and

C_0 = initial unloaded cylinder circumference
C = cylinder circumference under load
E = linear separation between cylinder halves

The internal pressure was found from the following expression:

$$P = \frac{F}{wd}$$

where P = pressure in pounds per square inch
F = tensile load on cylindric halves in pounds
w = width of bandage in inches
d = diameter of cylinder in inches

Both of the foregoing expressions are approximate but are adequate for these tests.

Two types of tests were conducted. The first was a tension test to failure. The results are shown graphically in Figure 3. The second type test was a creep test. Creep is recorded as elongation vs. time for a constant load. Two values of load were used: 70 per cent of the ultimate tensile load and the load corresponding to 40 mm. Hg pressure. The 40 mm. Hg pressure was chosen as being approximately the venous occlusion pressure. The results of the creep tests are shown in Figures 4 and 5.

CONCLUSIONS

Figure 3 shows both bandage types as having nearly the same modulus of elasticity (the slope of the straight portion of the curve). The tests conducted with single layers of bandage showed the standard bandage to have a much higher modulus of elasticity. (Fig. 1, Part 1.) A partial explanation of this difference in test results may be due to the adherence of layers of the special bandage to one another. This could cause the multilayer wrap of the special bandage to act as a unit and thus resist elongation more than a single layer would. The standard bandage lacks this interlayer adherence and thus the layers are free to slip over one another to equalize the loading, giving similar results to the single layer tests. The tendency, then, is to equalize the elastic modulus of the two bandages when used in multilayer wraps. (The standard bandage, without the loose ends fastened, would unwind under a very light load while the special bandage could hold to failure without the ends fixed. Tape was used to secure the ends of the wrap in all tests.)

Figure 5 shows the creep curves for the two bandages under 40 mm. Hg pressure. The slopes of the two curves are almost equal; thus the two bandage types at this pressure would continue to yield at the same rate after the load has been applied. Figure 4 shows the creep curves at a much higher pressure. The special bandage shows the higher creep rate.

Figure 3 could be used to determine the pressure produced inside a bandage wrap as a function of expansion of the bandage due to swelling. The pressure indicated by Figure 3 would have to be reduced by estimating the creep that had taken place, from Figure 4 or 5, and correcting the circumference ratio by subtracting the creep and reentering Figure 3 to determine a corrected pressure. For the foregoing procedures to be practical, many more creep runs would have to be made to fill in the gaps in the data.

In summary, both the conventional and webril bandages have essentially the same stretch when considered in single test sheets. However, when wrapped three layers thick and subjected to expanding pressure, the old conventional sheet wadding will yield by sliding, layer over layer, while webril will stick across layers and will not slide. In addition, webril in a test sample was shown to have twice the tensile strength of regular sheet wadding.

One of us has had two unfortunate experiences which were apparently the result of the inability of webril to slide and stretch. Triple arthrodesis of the tarsus was performed on a fifty year old man. The indication for the operation was malunited fracture of the os calcis with resultant traumatic arthritis of the talocalcaneal joint. After the wound was closed, gauze squares were placed over it and sterile webril was used as padding for the plaster of paris cast that extended from toes to midthigh. The webril padding was wound rather loosely around the foot since it was impossible to apply it tightly because of two Steinmann pins which were projecting out of the skin of the foot. These pins were used to fix the talocalcaneal and calcaneocuboid joint in the desired position of close coaptation. The cast and webril padding were not split, however.

Twenty-four hours postoperatively the cast was split on the dorsal aspect of the foot and leg. The webril padding was found to be tightly bound over the swollen foot. It was split with considerable difficulty to the bare, tense skin. The patient's course was stormy. He complained of a great deal of pain and his temperature was 100° to 101°F. daily. On the fifth postoperative day the cast was changed. Large amounts of pus poured from the wound on the lateral aspect of the foot and the skin on the dorsum of the foot was black and avascular. The large area of necrotic skin was removed, as were the two Steinmann pins, and a new plaster of paris cast was applied using sheet wadding for padding. The wound was dressed daily through a window in the plaster cast. Eventual arthrodesis of the tarsal joints and healing of the wound occurred. However, drainage from the wound continued for five months after the operation.

A second instance occurred in which it seemed that the webril contributed to an impeding Volkmann's ischemia. A boy of thirteen was seen who had an undisplaced fracture of the olecranon. A plaster of paris cast was applied from axilla to knuckles. The elbow was placed in partial extension to relax pull of the triceps muscle on the olecranon and to prevent excessive tension in the antecubital space. Padding used was webril in three layers.

The patient had increasing pain during the subsequent forty-eight hours until his physician was called. The fingers were markedly swollen despite the elevation of the cast and arm on two pillows. The fingers could not be extended from the palm and any attempt to extend them caused severe pain. The cast was bivalved. The anterior half of the plaster and padding were discarded. With continued elevation of the arm the swelling gradually subsided, and with continued active and passive stretching of the fingers complete recovery of the partial contracture took place.

COMMENT

Although it cannot be proved that the cause of the large skin slough in the first case was the unyielding webril, the probability is that such was the case. We know that skin sloughs are frequent after triple arthrodesis, but this slough was much too large to be accounted for by simple operative trauma. In the second case, the position of the patient's elbow was one of extension, not of flexion, so that here also the most probable factor was the webril padding.

Webril may be used safely where there is little likelihood of swelling after application of the plaster cast. It is a valuable material for use in convalescent fracture cases, in casts for arthritic joints and for other similar cases. For such instances it is probably superior to sheet wadding. For postoperative padding or immediately after a fracture it is unsafe unless it is split or torn completely so that there is no single complete circular layer.

Medial Parameniscus Bursitis of the Knee

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PATHOLOGICALLY adherent bursae in the vicinity of the tibial collateral ligament may look so much like true parameniscus cysts that microscopic examination will be necessary to differentiate between these two conditions. Two such personal cases will serve to illustrate the need for more accurate diagnosis and treatment in order to prevent needless sacrifice of normal meniscuses. Both lesions were seen in young boys aged seven and six years, respectively. (Fig. 1, Case II.) Operations were performed because the tumors had been present for several months, had been increasing in size, caused discomfort and limp and worried the mothers, and finally because a diagnosis of meniscal cyst had been made in each case.

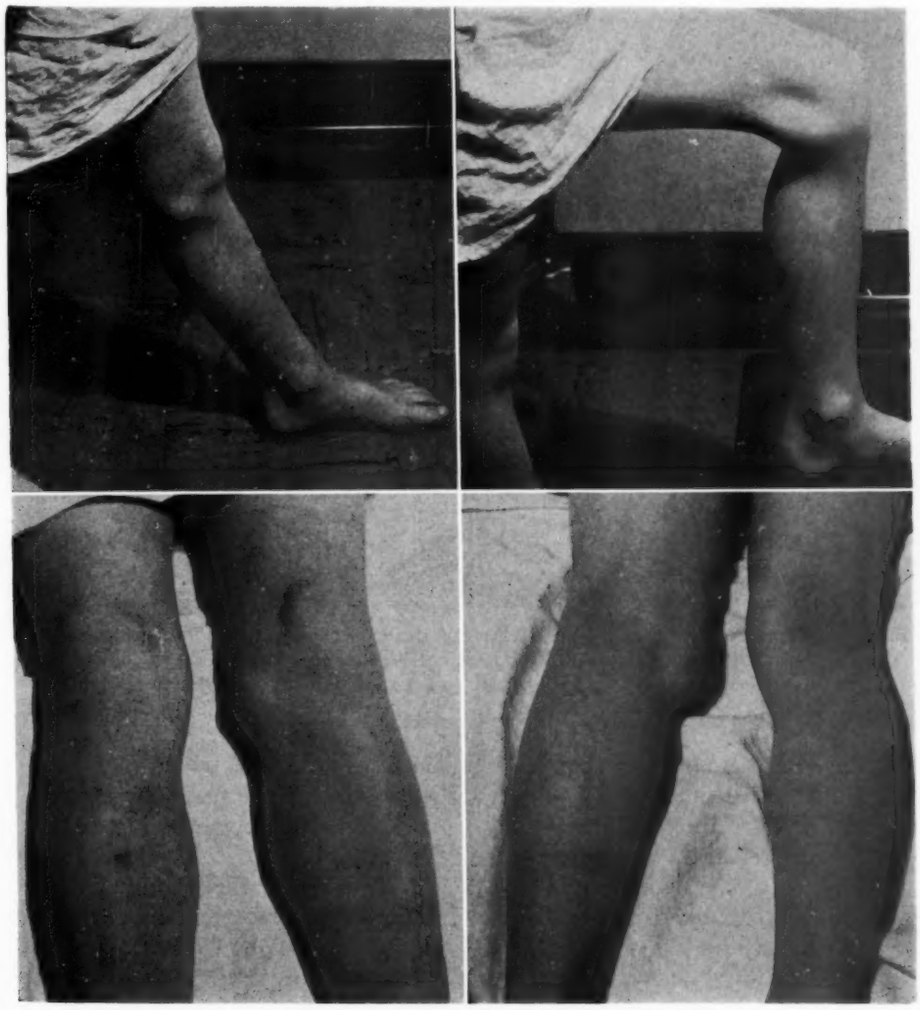

FIG. 1. Appearance of the left knee in Case II. Distinguishing features included the relative large size of the cystic mass, tenderness and apparent movement with the tibia during flexion and extension as would be expected of a true meniscus cyst. In the first case (right knee) the gross appearance was the same.

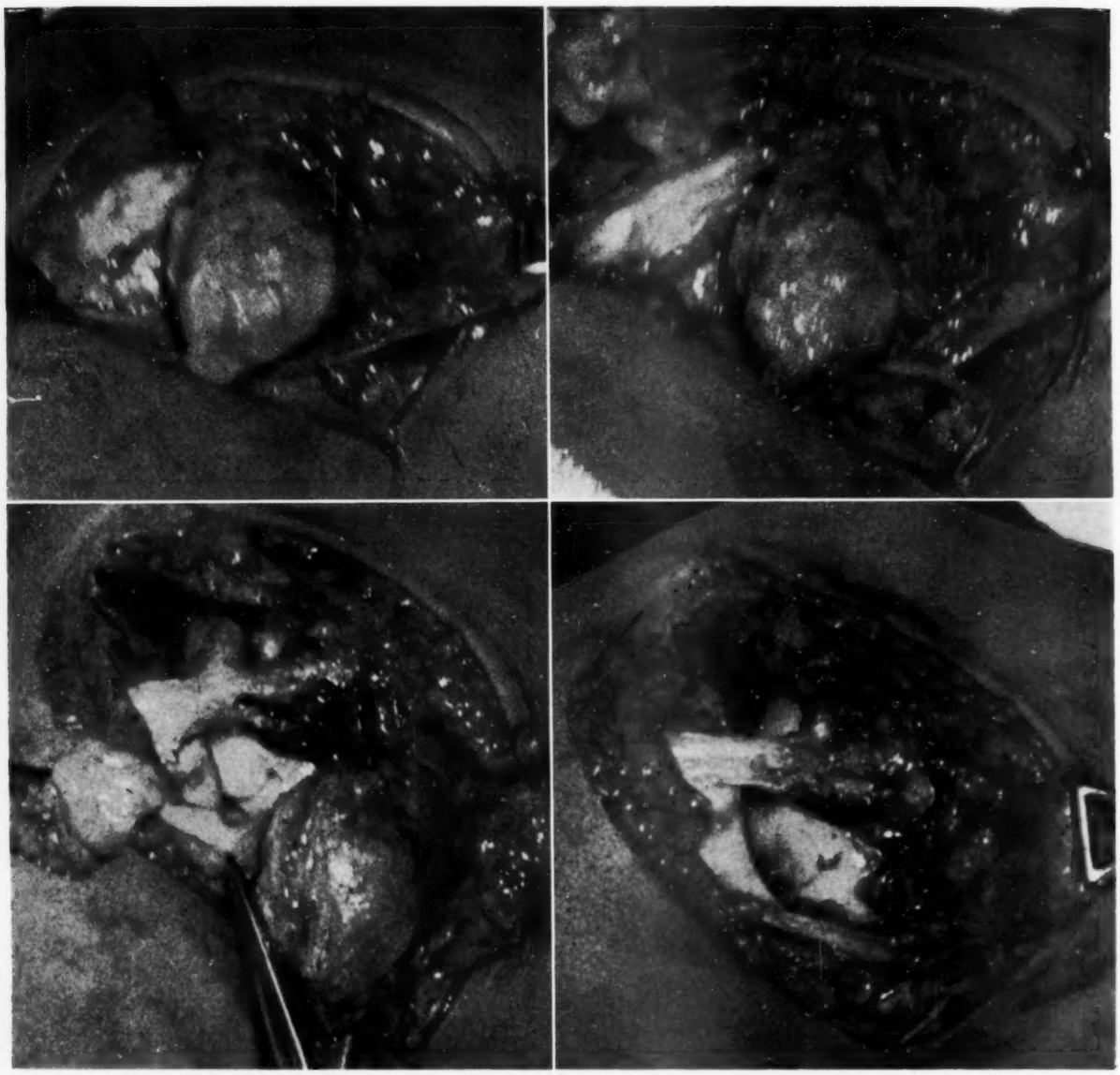

FIG. 2. Right knee at operation, Case I. Upper left, after sartorius had been cut and reflected; upper right, anterior attachment of the meniscus has been detached (tibial collateral ligament is prominent); lower left, meniscus and related cyst has been dissected backward leaving tibial collateral ligament intact; lower right, appearance after complete removal of meniscus and sac.

The outstanding features noted at operation (Fig. 2, Case I) included intimate relations of the cystic tumors to surrounding tissues which made dissection somewhat difficult, close relations of the tumors to the tibial collateral ligament, firm attachment of the tumors to their respective meniscuses by a broad base, the relatively large size of the cystic masses themselves and the normal appearance of the meniscuses themselves insofar as it was possible to inspect these structures. The latter is somewhat limited at best unless one employs an incision which cuts through the ligamentous structures of the joint, be it medial or lateral. In Case I the mass was further back under the hamstrings. In the second case the tumor was under the sartorius tendon. The sac was accidentally nicked, allowing the gelatinous material to escape in Case II. This error made it necessary to remove the collapsed sac separately from the meniscus, to which it was firmly attached nonetheless, by sharp dissection. The meniscuses were removed in both cases because it was thought that the cysts had

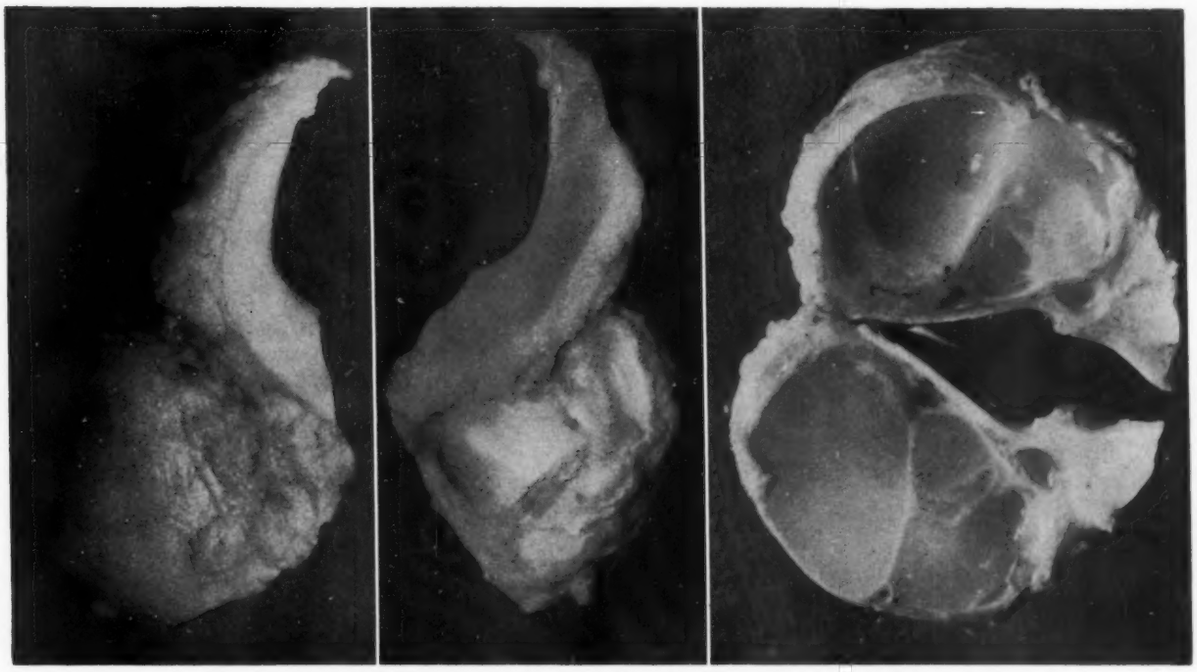

FIG. 3. Case 1. Gross specimen, medial meniscus and sac, right knee.

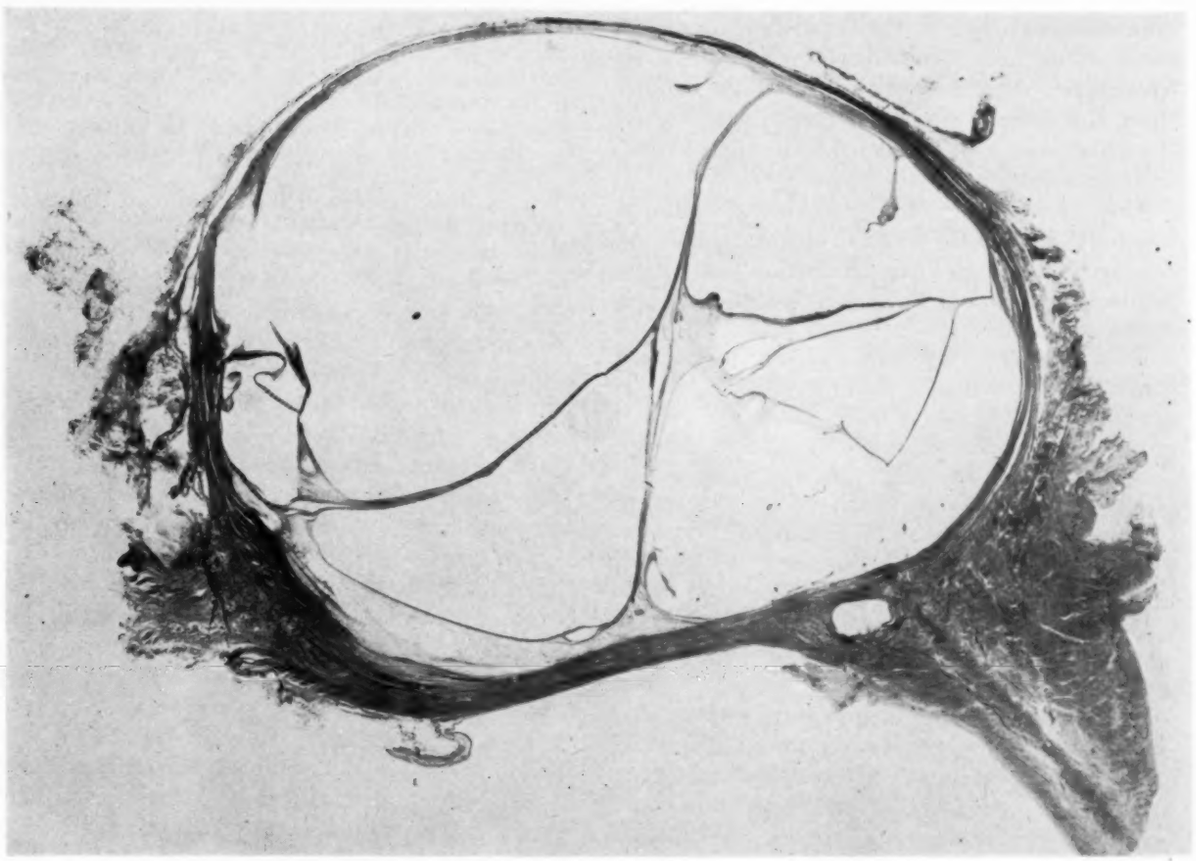

FIG. 4. Case 1. Low power photomicrograph showing normal meniscus structure.

originated from these structures. Neither meniscus showed any evidence of abnormality or trauma on its surface. (Fig. 3, Case 1.) The tumors measured approximately 2.5 by 3 cm., respectively.

Because of the relative infrequency of true medial meniscal cyst the pathologic specimens were sent elsewhere after having been studied locally. In both instances the diagnosis of bursitis (with normal meniscuses) was made by two individual pathologists. Without wishing to add fuel to the old debate regarding the lining cells of bursae and meniscal cysts, it is to be remarked that one of these bursal sacs was lined by endothelial cells (Fig. 4, Case 1) and the second by a thin layer of connective tissue cells. Not too much importance is to be attached to this factor. However, most writers believe that endothelial linings indicate an extrameniscus origin of the so-called cysts. True pathologic criteria which point toward meniscus cyst are: lobulated multiloculated structure actually arising from meniscus tissue (usually can be seen with the naked eye on cross section) and some gross evidence of traumatic damage to the meniscus. The vast majority of these arise from lateral meniscuses. Moreover, true meniscus cysts are smaller than the bursal sacs just described. Larger lesions should arouse suspicion of their bursal or synovial origin.

The two cases of parameniscal bursitis (medial) mentioned herein demonstrate the similarity between this condition and true meniscal cyst on clinical grounds alone. On the other hand, both conditions can be clearly differentiated by careful microscopic examination. Clinicians would do well to adopt a more accurate nomenclature in referring to these lesions. The term "parameniscus cyst" is a misnomer but is being used by some writers indiscriminately. The two conditions, bursitis and cyst, should be clearly designated by the terms "parameniscus bursitis" and "meniscus cyst," respectively. For statistical purposes no case should be labeled meniscus cyst (whether lateral or medial, but especially the latter) or bursitis unless the diagnosis has been confirmed by microscopic examination. On the whole it would seem that medial meniscus cysts are even rarer than was formerly thought to be the case. By the same token, medial parameniscus bursitis is more common than is generally appreciated.

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Rayon Contact Dressings for Orthopedic Wounds

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The use of rayon as a dressing for wounds first interested me in 1945 when I saw Dr. Neal Owens use it after plastic surgery procedures. For the past five years I have used "Owens surgical fabric" routinely as a contact dressing over all clean closures of orthopedic operations, skin grafts, donor surfaces and plastic procedures, and even on many open surface wounds of burns, débridements and infected open wounds. Results have been more satisfactory with this fabric than with those obtained with any other type of dressing.

Instead of reviewing the historic data of research,[1] suffice it to say that the "Owens surgical fabric" is a very fine, thin rayon which has proved a most happy solution to the problem of removing dressings without pain or discomfort, and with the least injury to the open wound surfaces, granulations or healing, stitched closures. (Rayon is a fabric woven from a glossy fiber made by forcing a sulfonamide solution of cellulose acetate through minute holes and drying the filaments in air or chemicals. This particular fabric has a fiber size of 30 denier, the number of threads warp and weft 114 by 114. This thickness is .0020.)

Having been taught the Orr treatment[2] of vaseline gauze in the care of infected wounds and open wounds which could not be closed, and having adapted for many years gauze buttered with vaseline as the contact dressing for clean closures (because of its non-adherence to the sound surface), the broad experience gained thereby enabled me to appreciate the many desirable, as well as undesirable, qualities of such procedures. These qualities are the same in all types of grease and ointment dressings, for in spite of the impregnation of the grease the capillary buds infiltrate the gauze and will be torn and then bleed when the dressings are removed; they often stick to the clean closure of a wound, causing pain and additional bleeding when the dressings are removed. When there is leakage, secretion or drainage of pus in an infected wound, puddling occurs under the dressings because grease is impermeable to an extent and the exudate pushes out at the margins, causing irritation to otherwise healthy tissue.

My experience, which coincides with that of Dr. Owens in the use of fine mesh rayon fabric and its application to all types of wounds, shows that rayon conforms to the following physiologic principles which are essential for an ideal contact dressing: (1) it is easily sterilized, (2) it has a close enough weave to prevent capillary invasion into the meshes of the fabric, (3) it is loose enough to permit adequate drainage, (4) its friction coefficient is sufficiently low to reflect minimal irritation to the wound surface, and (5) it can be removed from the wound when moistened with saline solution without sticking, which reduces bleeding, pain and discomfort to the patient.

The technic of its application is simple. The fabric is autoclaved as needed. The clean, sutured, operative wound is covered with a single thickness strip, 1 to 2 inches wide, which is tailored to the length, size and shape of the wound. It is moistened in normal saline solution when applied and reinforced with the usual overlaying gauze dressings. Mechanic's waste is usually used as a compression dressing over all wounds of the lower extremity, particularly those in which the joint has been opened and there is likelihood of bulging of the joint membranes with blood. Over the waste is placed firm sheet wadding or webril® bandage, crepe paper, bias muslin or an elastic bandage. Of course, as the joint and wound are kept less boggy with blood, the healing will be more rapid and the dressings will be less soiled.

After the fourth or fifth day dressings can be reapplied without pressure because the danger of bleeding by this time has passed.

When a cast is required, it must be fenestrated for wound inspection and removal of the initial dressings. After observation the open space must be carefully filled with either sterile gauze or waste to stabilize pressure, and then fixed in position. When healing has occurred and the upper dressings have been removed, the rayon is moistened with normal saline solution so that it literally floats off when lifted with a forceps. Often the wound has remained completely dry and the contact fabric is free of any adherence to integument.

There are few patients who do not dread the removal of ordinary gauze dressings. Whether or not they are moistened they usually stick and sometimes painfully tear the serous scab from the healing incision to the extent that bleeding occurs; at the time of the next dressings the same discomfort is anticipated and assured. The contact rayon strip eliminates all the discomfort and incision injury. These two qualities make it a thoroughly worth while dressing for all closures of operative wounds.

Freshly débrided wounds, which cannot be closed or in which it is undesirable to apply a primary skin graft, may be covered with the contact rayon tailored smoothly to cover the entire wound. This tailored patch is then moistened with normal saline solution at the time of its application. We do not use any antiseptic, antibiotic or sulfanilamide preparation in the wound but are content with the adequacy of the surgical toilet and antibiotics for the prevention of infection. (Dr. Owens recommends that the rayon be moistened with a normal saline solution of 2 per cent acetic acid buffered with a hydrogen-ion concentration of 4 with sodium acetate.)[1] The usual pressure dressing of mechanic's waste is applied, and when the pressure is removed after a few days the rayon stained with blood and serous exudate can be loosened by again moistening with saline. The rayon is then easily removed and instead of a bleeding, painful surface (which is ordinarily met with when gauze or grease is used) we find a healthy, smooth, velvety red, granulating surface which most likely is ready for a skin graft.

Over a split-skin graft, a single tailored moist rayon cover is placed, and a pressure dressing is again applied. When it is time to change the dressings, the pressure dressings are removed and the rayon is readily removed by moistening.

Open infected wounds that are covered with contact rayon must be kept moist with saline; otherwise, the dressings become saturated with exudate and tend to dry in the upper layers of the gauze and prevent adequate through and through drainage, thus producing puddling, absorption and irritation of the integument around the wound.

With all wounds—whether open, closed, clean or infected—one should never use but a single thickness of contact rayon cover since a double thickness is less permeable and tends to prevent the secretions from draining. Occasionally, there are instances in dealing with clean, closed wounds when sebaceous material collects at the edges of the incised skin and causes persistent sticking of the rayon; a little ether, causing no discomfort except coldness, will readily dissolve the sticking matter.

CONCLUSIONS

After using this contact rayon fabric routinely for several years on various types of wounds, I believe that it contributes to the physiologic process of healing by: (1) permitting adequate drainage, (2) preventing the penetration of capillary buds into the fine mesh of the fabric, (3) reducing friction in the wound to a minimum, (4) stabilizing the tissues with the use of overlying pressure dressings and (5) by possessing the aforementioned qualities, it reduces the possibility of infection.

Furthermore, without consideration of the foregoing conclusions, rayon contact covering can so easily be removed without apprehension, pain and discomfort to the patient that this quality alone makes it an ideal refinement in wound dressing technic.

Acknowledgment: The author wishes to acknowledge the generosity of C. L. Hamilton, President of Winchester Mills, Inc., New York, New York, for making this fabric available for his use prior to its being placed on the market as a surgical dressing.

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The Physics of the Abdominal Cavity and the Problem of Peritoneal Drainage

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IN spite of all antibiotics, abdominal drainage is necessary to rid the peritoneal cavity of undesirable fluid collections and to prevent the dangerous consequences of leaks following a wide range of abdominal operations (for example, biliary tract surgery, duodenal stump blowouts, partial and total gastrectomies, pancreatoduodenectomies). Pleural drainage is always successful because it is based on an exact knowledge of the physics of the pleural cavity. Abdominal drainage is a less reliable procedure. A reappraisal of the physics of the abdominal cavity seems therefore desirable to establish a sound basis for a working abdominal drainage system.

If, for practical purposes, the parenchymatous organs are omitted from the discussion, the abdominal cavity contains two separate compartments, namely, (1) the gastrointestinal tract between the esophageal hiatus and the musculature of the pelvic floor, and (2) the peritoneal cavity proper. This is the serosal space between the parietal and the visceral peritoneum.

The two compartments are strictly separate units in spite of their close anatomic proximity. This is shown by the different pressure situation within each of them.

The normal intraluminal pressure of the human intestines as determined by a balloon recording system with the inflatable balloon of the Miller-Abbott tube is positive and given as 15 to 25 cm. of water. The intraluminal pressure is, for all practical purposes, identical with what is commonly called the intra-abdominal pressure. It increases with intestinal distention, accumulation of fluid in the peritoneal cavity (ascites), adiposity, pregnancy and the temporary contractions of the muscular walls of the abdominal cavity (parietal muscles, diaphragm, pelvic floor).

The pressure within the peritoneal cavity can be determined by direct manometric readings with an open manometer during the administration of pneumoperitoneum in the treatment of pulmonary tuberculosis.[2] The sites for administration of pneumoperitoneum and pressure readings are either subcostal (subdiaphragmatic region) or a point somewhat to the left and below the umbilicus. These readings show that the mean pressure in the subdiaphragmatic space is always subatmospheric. It fluctuates with the respiratory movement of the diaphragm, becoming more negative on inspiration. Overholt[3] mentioned that free diaphragmatic activity is helped by a preexistant subatmospheric pressure in the upper part of the peritoneal cavity. In dog experiments and in all animals examined in the horizontal or head-up position, when the animals were breathing quietly, a mean subatmospheric pressure was found in the epigastric region. Livingston[4] stated that with thoracic and normal abdominothoracic breathing the intraperitoneal pressure tends to fall with inspiration. He explains the phenomenon as the increased negative pleural pressure during inspiration being transmitted to the subdiaphragmatic and subhepatic spaces. A somewhat different explanation of the mechanism is that the increase of the circumference of the lower thoracic aperture during inspiration increases the negativity primarily present in the upper part of the sealed peritoneal cavity.

In the subumbilical region the intraperitoneal pressure is neutral. No permanent positive pressure could be established by air insufflation. The pressure remains near a zero level for all volumes of air injected. This points to some abdominal accommodation of a near atmospheric pressure.

No gaseous interchange takes place between compartment one and two except under pathologic conditions such as perforation of a hollow viscus. Therefore, the peritoneal cavity resembles a vacoliter infusion bottle. To initiate outflow of the solution from the bottle an air vent must first be established. The

mechanism of emptying the fluid contents of the peritoneal cavity is the same as the one required for draining fluid from the infusion bottle. An atmospheric pressure must be created within the subhepatic space and the emptying must take place at a most dependent site, i.e., Morison's kidney pouch which may accommodate more than a pint of fluid before overflow into the lateral gutter takes place.

Each laparotomy is followed by pneumoperitoneum. When the abdomen is opened by a subcostal incision, the entrance of air may be noticed on close examination. Pneumoperitoneum after laparotomy can be easily visualized on x-ray films taken with the patient in a lateral recumbent position and with the x-ray plate on the abdomen or the back.

This postoperative pneumoperitoneum, which is usually reabsorbed within a few days, is responsible for the onset of any peritoneal drainage. To make this drainage completely effective, not only must the drainage site be chosen at the lowermost point of the cavity, but also postoperative pneumoperitoneum must be maintained for a time sufficiently long to drain the peritoneum of all its fluid content. This is accomplished by inserting a second noncollapsible rubber drain into the subhepatic space as an air vent, aside from the drain used for the proper drainage.

For a working peritoneal drainage, a two-way drainage system is necessary: (1) air vent for maintenance of atmospheric pressure within the sub-hepatic space, and (2) the drainage tube proper brought out from the most dependent site of the peritoneal cavity. For the upper abdomen this drainage is accomplished by tubes brought in through stab incisions in the right or left flank below the tip of the eleventh rib. As opposed to suction which is necessary for decompression of the intestine with its positive intraluminal pressure, suction on an abdominal drainage tube without added air vent will only lead to early sealing-off of the drainage tube.

This method has been used since 1947. In my experience it has never failed. One illustrative case should be briefly mentioned.

In June, 1947, a fifty-six year old man was operated upon for ulcerocarcinoma located on the lesser curvature of the stomach above the angle, with formation of an hourglass deformity. There was a definite stricture within the hourglass straits. The tumor adhered to the pancreatic capsule and had grown through the transverse mesocolon. The middle colic artery could be spared on mobilizing the tumor. After closure of the duodenum and freeing of the stomach, a clamp was placed high up on the stomach. In spite of Levin tube suction and needle aspiration, the upper sac of the stomach could not be deflated. When the retrocolic gastrojejunostomy had just begun, the stomach slipped out of the clamp and an enormous amount of blackish stomach contents, mixed with barium, flooded the entire operative field. The fluid was aspirated as thoroughly as possible and the anastomosis was completed.

Before closure of the abdomen, two wide rubber drains were brought in from both flanks to the subhepatic spaces; one from the right side into Morison's pouch and the other from the left behind the stomach remnant. The immediate outlook was considered grave. On the evening of the operation the patient was actually found to be bathed in blackish fluid which had drained freely from the peritoneal cavity. The drainage decreased rapidly and the further postoperative course was completely uneventful. The patient left the hospital fifteen days later with a healed wound. Penicillin therapy had been used in this case.

In cases of massive drainage due to intra-abdominal leakage with secretory pressure, a drainage bottle may be attached to the tube for gravity drainage. Fowler's position, which was formerly used as a standard procedure in cases of all perforative abdominal diseases, certainly has no place in the treatment of subhepatic fluid collections. However, Gross[10] still uses Fowler's position in cases of perforative appendicitis.

In the meantime I learned about the method of draining with the two-arm looped Chaffin tube. This tube is 8 inches long with an inside diameter of $\frac{5}{16}$ inch and eyelets on the convexity of the loop. One tube end is an air vent and the second tube end is connected with a suction pump. The eyelets must reach the fluid collection which is levered out by slow suction. No suction should reach the eyelets. A Chaffin tube brought in through a suprapubic incision is certainly the best drainage for perforative pelvic disease. Wangensteen,[9] following total gastrectomies, uses a double tube working on a Chaffin principle and assembled from two tubes.

The longer tube is a No. 10 to 12 French catheter. The shorter tube is a No. 22 French rectal tube. The tip of the longer tube projects 1 to 2 cm. beyond the shorter one. Suction is applied to the larger tube. Both methods meet the physical principles of peritoneal drainage which have been discussed previously. A Chaffin double tube creates the required physical condition for drainage of the pelvic cavity by permitting air to enter the abdomen during the entire period of drainage.

SUMMARY

Draining of the peritoneal cavity is governed by physical laws. The mean pressure in the subhepatic area is subatmospheric and neutral or near zero in the subumbilical regions. The peritoneum therefore resembles an infusion bottle. To obtain an outflow of peritoneal fluid contents, an air vent must be added to the tube destined to drain the peritoneal cavity. A Chaffin double tube which maintains a positive pressure within the peritoneal space while emptying the fluid by slow suction is a most suitable aid for a working abdominal drainage in which gravity drainage cannot be used.

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Incisional and Umbilical Hernias

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AN important problem in abdominal surgery is the prevention and repair of incisional and umbilical hernias. Standard textbooks advise overlapping the peritoneum and the fascia, and using catgut or cotton or silk in incisional and umbilical hernias, according to the technic described by Mayo in 1899.[1] Later articles have described many other methods, including the use of strips of fascia lata, tantalum gauze, dermis grafts and other ingenious technics, all of which have their special proponents. Unfortunately, according to Watson,[2] the recurrence rate with older methods is high, which accounts for continued search for a better method.

In August, 1947, Pink[3] described an operation based on a different principle, namely, inversion of the sac with catgut and then inversion of the fascia with two rows of No. 30 steel wire sutures. He quotes at length from an article by Haynes published in 1913, in which he described a similar operation.

TECHNIC OF OPERATION

Because of dissatisfaction with the results obtained with the older methods, in 1949 I started using the steel wire inversion technic in both incisional and umbilical hernias. I modified Pink's operation by almost always opening and excising the sac, freeing adhesions and exploring the abdomen. The peritoneum is then closed with a running stitch of No. 0 chromic catgut, after which the fat is dissected away from the fascia for 3 or 4 cm. all around the wound. The fascia is closed, first with a running stitch of No. 32 steel wire, beginning and ending 3 cm. beyond the ends of the hernial ring. The next row of wire sutures is a continuous Lembert stitch, inverting the first suture line upon itself, thus protecting it from tension. In large hernias when there is considerable abdominal relaxation one or two additional rows of continuous Lembert sutures of No. 32 steel wire are introduced, which still further inverts and strengthens the wound.

The technic of peritoneal and fascial closure is illustrated in Figure 1A, B and C. The redundant fat and skin are then excised and the wound is closed with interrupted, deeply placed steel wire, cotton or dermalon sutures. A Penrose drain is usually left in the angle of the wound for twenty-four or forty-eight hours. In umbilical and most incisional hernias a transverse elliptic incision is used, but occasionally a vertical or diagonal elliptic incision is advisable.

Early ambulation is encouraged, since divulsion is impossible as the fascia is held permanently with non-irritating steel sutures. My results with this method have been excellent, even in very large hernias.

In order to verify my clinical impression, I reviewed the histories of all my adult patients operated upon for incisional and umbilical hernias during the past ten years. I found a total of forty-six patients on whom fifty-four operations were performed.

The first group consisted of fifteen incisional hernias in which repair was carried out by overlapping the fascia and using chromic catgut or cotton sutures reinforced in most cases with fascia lata strips. Unfortunately, recurrence occurred following five of these operations, or 33.3 per cent. During the same years I repaired fourteen umbilical hernias by the overlapping technic, using chromic catgut or cotton sutures sometimes reinforced by fascial strips; there were three failures, a recurrence of 21 per cent.

The second group consisted of nineteen incisional and six large umbilical hernias repaired by the steel wire imbricating technic described in this report, with one failure. The only recurrence followed one early operation (using the technic of Pink) in which a very large combined incisional and umbilical hernia was closed first with two rows of chromic catgut reinforced with fascia lata strips, and then two rows of No. 32 steel wire continuous Lembert sutures. Probably the two rows of chromic catgut and the fascial strips prevented the close contact of the fascia necessary for satisfactory healing and predisposed to

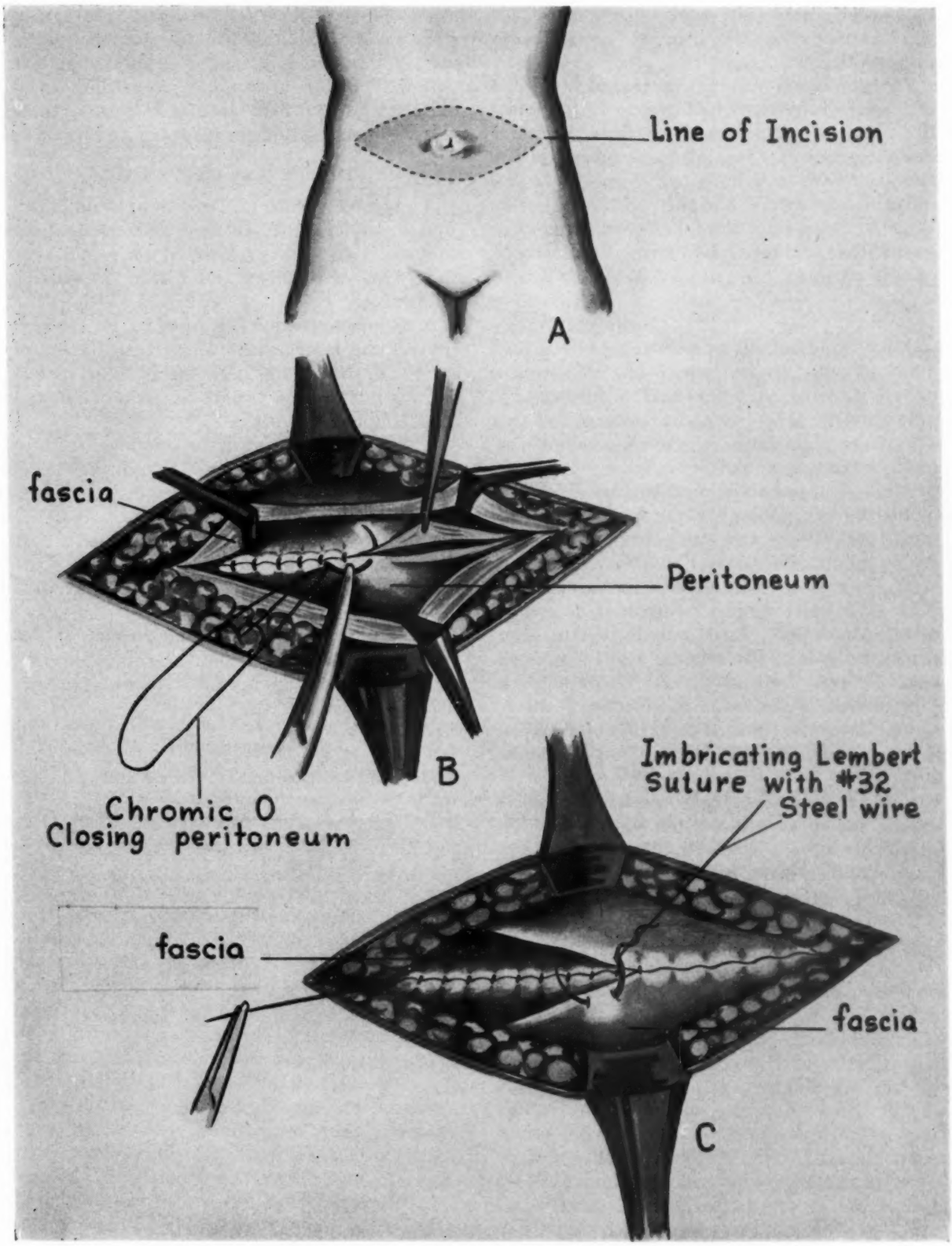

FIG. 1. Illustration of steps in the technic of umbilical or incisional hernial repair.

recurrence. Since this experience I have adhered strictly to the original technic with uniform success.

An interesting observation is that one-third of the steel wire cases had postoperative infection in the wound with profuse purulent drainage. However, the ultimate success of the operation was not impaired. Apparently the infection was confined to the subcutaneous fat. When such an infection follows wound closure with catgut and fascia lata strips, a recurrence usually results.

PREVENTION OF POSTOPERATIVE HERNIAS

A few words about prophylaxis of incisional hernias may be in order. The McBurney muscle-splitting incision is seldom followed by a hernia even when purulent drainage follows. The paramedian incision with reflection of the rectus muscle outward is my choice for both pelvic and upper abdominal surgery since the rectus muscle separates the peritoneal and fascial suture lines and strengthens the wound. As an additional precaution, No. 24 cotton interrupted sutures are used in the fascia.

In gallbladder surgery, when it is necessary to split the upper rectus muscle, the incision should be as near the midline and as short as possible, and drainage should be through a stab wound. If the fascia is closed with interrupted cotton sutures, a postoperative hernia never occurs, unless the wound becomes infected.

A review of 1,000 laparotomies performed by the author in the last ten years, one-fifth of which were cholecystectomies, showed that incisional hernias developed in only eight cases. Three of them followed gallbladder operations complicated by prolonged biliary drainage and wound infection. The remaining five followed lower abdominal operations complicated by purulent wound infection, three of which were not clean cases before surgery.

SUMMARY AND CONCLUSIONS

1. The recurrence rate for repair of umbilical and incisional hernias by the classic overlapping method is high, being from 21 to 33 per cent in groups of fourteen and fifteen operations, respectively.

2. A new operation described by Pink which inverts the fascia with two or more layers of steel wire sutures has been successful in repairing all but one of twenty-five incisional and large umbilical hernias.

3. Steel wire closure is successful in spite of occasional postoperative infection of the superficial fat, and there are no late complications from its use.

4. Analysis of 1,000 laparotomies performed in the last ten years disclosed only eight postoperative incisional hernias, all of which followed purulent wound infections.

5. Paramedian incisions and closure of the fascia with interrupted No. 24 cotton sutures have been quite successful in preventing incisional hernias.

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Banthīne As an Adjunct in the Treatment of Salivary Fistulas

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VERY few injuries to the face are seen under conditions which allow for careful suture of a recognized injury to the parotid duct. While it has been said that few parotid duct fistulas persist,[1] the number of operations and maneuvers designed to cure this disability attest to the fact that it is not only common but also difficult to cure.

Salivary fistulas arising from the gland itself, as following partial resections, drainage of parotid abscess or injury, are least likely to persist; most of these fistulas close of their own accord. Those requiring treatment have responded to immobilization of the jaws by wires or bandages, cauterization with silver nitrate or actual cautery, and roentgen therapy.

Injuries to Stensen's duct have more frequently resulted in a persistent salivary fistula. Here, separation of the ends of the duct and epithelization of the fistula lead to a chronic condition. Fistulas arising from the duct anterior to the masseter muscle have been treated by implantation of the proximal end of the duct into the mouth or by numerous methods designed to create an internal salivary fistula. Those fistulas arising from the duct over the masseter muscle have been treated by plastic reconstruction of the duct, using mucosal flaps or adjacent facial veins as grafts. Ligation of the duct in this area is said to cause atrophy of the gland and cure of the fistula.

Aigrot[2] has described the cure of Stensen's duct fistulas by avulsion of the auriculotemporal nerve. The operations were performed by his surgical chief, René Leriche. Leriche[3] later wrote on the effectiveness of this procedure. The salivary glands are under the control of the sympathetic and parasympathetic nervous systems. The parasympathetic supply to the parotid gland leaves the medulla in association with the ninth cranial nerve. The fibers leave the ninth nerve at the jugular foramen and go to the otic ganglion where they communicate with ganglion cells. The postganglionic fibers go by way of the auriculotemporal branch of the fifth cranial nerve to the parotid gland. Stimulation of the auriculotemporal nerve leads to an abundant, watery secretion. Section of the nerve with its included parasympathetic fibers was found by Leriche to be effective in decreasing salivation and to bring about closure of fistulas.

CASE REPORT

The patient was a forty-five year old Negro who was seen shortly after a knife fight in which he suffered a deep and long laceration of his left cheek. He had lost a good deal of blood and was still bleeding severely when the wound was sutured. Although the probability of injury to Stensen's duct was considered, this structure was not seen or searched for, the procedure being undertaken in a doctor's office 30 miles from the hospital for the control of bleeding. On the fourth day after injury a profuse watery drainage was noted from the anterior end of the laceration. On the seventh day all of the skin sutures were removed and the wound was noted to be healing well. The salivary fistula persisted undiminished. Two weeks after injury the wound was well healed but the salivary fistula remained. With the idea of decreasing parasympathetic activation of the parotid gland, the patient was started on banthīne,® 50 mg. every six hours. It was hoped that this would decrease salivary output to the point where the fistula would heal. Banthīne, rather than pro-banthīne, was chosen because of its greater effect on salivation. When the patient was next seen, one week after institution of this treatment, the salivary fistula had closed.

SUMMARY

A maneuver has been presented which seems to have been instrumental in bringing about the closure of a fistula of Stensen's duct. Although it cannot be said that this fistula would not have closed of its own accord, it is suggested that the use of banthīne is a worth while adjunct in the early treatment of these fistulas, treatment at a time which is critical in determining whether or not the fistula will become permanently established. It is thought that if the ends of the severed duct are in close approximation or can be brought together by primary or secondary suture, parasympathetic inhibition will permit them to heal. If the ends are widely separated or the distal end is destroyed, inhibition of salivation will permit cicatricial closure of the fistula before epithelization takes place to make the channel permanent.

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Mainetti and Triaca describe an interesting case of endometriosis of the navel. A purplish tumor was present at the umbilicus and it would become engorged during the patient's menses. After cesarean section the growth, which at first resembled melanosarcoma or angioma, broke down and a menstrual fistula developed. Excision of tumor and of the left tube and ovary from which the left tubo-ovarian endometritis arose, effected a cure. The authors suggest that diagnosis might be facilitated if patients are given large doses of estrogen with resultant increase in size of the navel mass, and large doses of male hormone with resultant diminution in the size of the mass. However, biopsy would be more conclusive.(*Richard A. Leonardo, M.D.*)

Obstruction of the Proximal Jejunal Loop Following Gastrectomy

MECHANISM AND PREVENTION

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SINCE the advent of gastric resection many problems have confronted the surgeon. Among these problems, varying degrees of stomal obstruction have been a common development postoperatively despite technical perfection. The purpose of this article is to discuss the frequency and importance of the obstructed proximal loop following gastrectomy of the Billroth II or Pólya type, and to report two illustrative cases of proximal loop obstruction.

Obstructions can be classified as mild, moderate or severe.

The mild early obstructions of the proximal loop are usually due to edema, excessive inversion or slight kinking at the stoma, and will subside with decompression and proper electrolyte, protein and fluid balance.[1]

The moderate type of obstruction is exemplified by the so-called afferent or proximal loop syndrome described by Wells and MacPhee.[2] This type is more persistent and can manifest itself immediately or weeks after gastrectomy. The symptoms are abdominal pressure and distention accompanied by increased motility, with a feeling of fullness and discomfort to the right of the midline. Pancreatic and biliary secretions may remain dammed up for days, giving rise to permanent nausea and anorexia. This condition is manifested by a bitter taste in the mouth with bilious regurgitation and occasionally sudden massive bilious vomiting of 1 to 2 pints with immediate relief. The published reports of postgastrectomy complications have been reviewed by Wells and MacPhee,[2] and their analysis indicates that perhaps half of the patients complain of some bilious regurgitation and may have had afferent loop stasis. They estimate the incidence of persistent partial proximal loop obstruction as 18 per cent of gastrectomies of every type except the Billroth I.

The severe type of proximal loop obstruction, more common after the antecolic, antiperistaltic type of anastomosis, is now being reported. This type of obstruction is very serious, and if unrecognized or untreated can result in a fatal closed loop type of obstruction high in the jejunum. This complication can occur days or years after gastrectomy[3] and is usually due to the long proximal loop passing between the shortened mesentery of the distal loop and the transverse colon. The mesentery of the distal jejunal loop compresses the proximal loop (Fig. 1), and the syndrome, if not recognized and detected early, results in torsion and gangrene of the proximal loop. Quinn and Gifford[3,4] were the first to describe this syndrome and reported five cases. In three of these the complication was not immediately recognized and the patients died. In the other two cases recovery followed surgical intervention which consisted of side-to-side anastomosis between the proximal and distal loops.

Recently West[5] reported three more cases of proximal loop obstruction following gastrectomy and an antecolic, antiperistaltic anastomosis. In each case the obstruction was due to rotation of the proximal loop of the jejunum behind the distal loop with resulting torsion and gangrene. West's first patient recovered after repeated operations for multiple fistulas of the proximal loop. His second and third patients did not recover. Postmortem examination disclosed extensive peritonitis secondary to multiple perforations of a markedly dilated

and necrotic proximal jejunum which had rotated behind the distal loop.

All the reported severe cases had certain symptoms in common: (1) unrelenting epigastric pain and tenderness accompanied by shock; (2) rather limited vomiting with absence of bile in the vomitus; and (3) perforation of the obstructed jejunal loop with peritonitis.

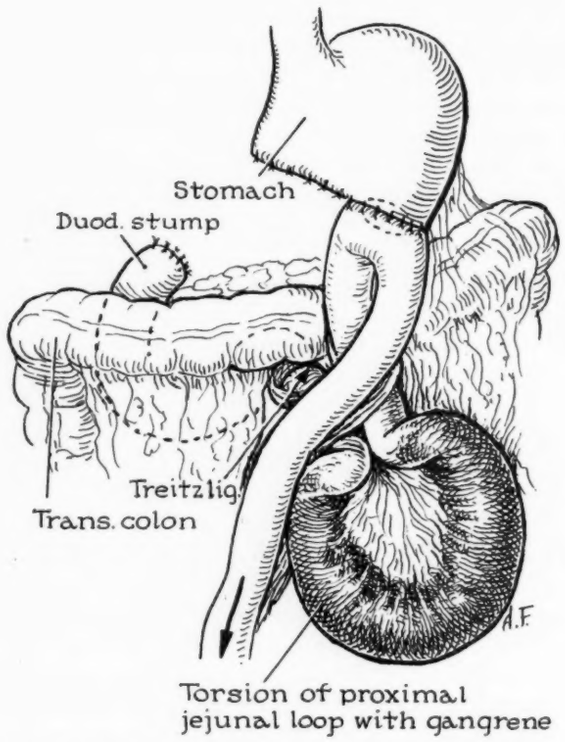

FIG. 1. Drawing showing torsion of the proximal loop with gangrene. Note how the proximal loop has passed under the shortened mesentery of the distal loop and twisted. The root of the small bowel mesentery runs an oblique line from the ligament of Treitz to the right lower quadrant of the abdomen. When the jejunum is attached to the stomach so that the distal loop is at the greater curvature and the proximal at the lesser (antiperistaltic), the mesentery of the distal loop becomes twisted about 135 degrees from this oblique line. The mesentery is shortened. The proximal loop, filled and distended with bile and pancreatic juice, can move in only one direction, i.e., to the left, under the shortened mesentery of the distal loop.

The reports of this serious mechanical obstruction are sparse. The cases reported probably represent only a small fraction of the total number for this complication can occur months or years after the original operation and the patients are often operated upon elsewhere (as in Case 1).

CASE REPORTS

CASE 1. A sixty-eight year old man was admitted to the St. Francis Hospital at 4:30 P.M. on January 14, 1952. He was acutely ill with severe upper abdominal pain, more marked on the left side. He stated that he had been well until 9 P.M. the day before, when he experienced sharp, penetrating upper abdominal pain extending to the left side of the upper abdomen. He vomited once but did not notice the character of the vomitus. He had had a bowel movement the previous day, but none on the day of admission. He was seen by a physician shortly after the initial attack. He received a sedative, and was hospitalized the following day when the pain persisted and abdominal distention developed. There was a twenty-four-hour interval between the onset of his symptoms and admission to the hospital.

His past history was essentially negative except for a history of chronic duodenal ulcer for which subtotal gastric resection had been performed at the Memorial Hospital, New York, about six months previously (July 31, 1952). The records indicated that an antecolic, antiperistaltic, Hofmeister type of anastomosis had been performed. Recovery was uneventful and the patient had been discharged improved on the eighteenth postoperative day. He had resumed his work and had been able to continue without interruption. On rare occasions he had had a feeling of fullness and discomfort in the upper abdomen with a bitter taste in the mouth and regurgitated small amounts of bile unmixed with food. He had noted the aforementioned symptoms several months after his operation, but they were occasional and not severe enough to interfere with his work. Except for the occasional mild symptoms described heretofore, he had felt perfectly well and had worked regularly until his present admission to the hospital.

Physical examination disclosed an elderly man with a dry tongue; his rectal temperature was 101°F., pulse 80, respirations 22 and blood pressure 115/70. His abdomen was greatly distended, with the distention more marked in the upper abdomen and to the left. A long subcostal transverse scar, well healed, was the site of previous gastrectomy. There was marked pain, tenderness and rebound

FIG. 2. Photograph of resected loop. Note gangrene of most of the specimen except the proximal 4 cm. and terminal 6 cm. Note the sharp line of demarcation between the gangrenous and normal bowel at site of mesenteric constriction and torsion (see pathologic report).

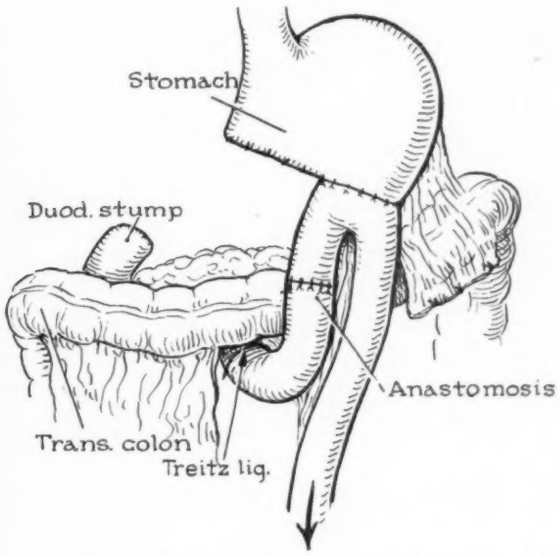

FIG. 3. Case 1. Drawing showing resection with end-to-end anastomosis. Open anastomosis performed with inner layer of gastrointestinal No. 00 chromic catgut and outer layer of interrupted fine silk. Interrupted fine silk for mesentery. Good pulsation in mesentery with free bleeding of ends ascertained prior to anastomosis.

tenderness, more marked in the upper abdomen and to the left. A mass could be felt in the left upper abdomen but with no distinct outline. The abdomen was silent. Rectal examination showed no abnormality except for a moderately enlarged prostate gland.

The patient was hydrated with 5 per cent glucose in saline. A Levin tube was inserted for continuous suction. A blood count, blood type, urinalysis and scout film of the abdomen were obtained.

X-ray report revealed the following: Flat plate of the abdomen demonstrated several loops of jejunum which were distended with gas and apparently fixed in the left upper quadrant. There were also loops of ileum which were moderately distended with gas. There was no evidence of free air within the peritoneum or beneath both diaphragmatic leaflets. The left diaphragmatic leaflet was moderately elevated.

The patient was operated upon under general narcosis two and a half hours after admission. A left upper rectus muscle-splitting incision was made below the old transverse scar. The peritoneal cavity contained a large quantity of bloody, foul-smelling exudate which was aspirated and cultured. A black, gangrenous loop of jejunum about 18 inches in length was found to be torsive about 6 inches below the former anastomosis. (Fig. 1.) The torsion was at the base of the mesentery which was very edematous. The involved loop was uncoiled and resected several inches proximal and distal to the area of infarction. (Fig. 2.) An end-to-end anastomosis was performed with one outer layer of interrupted fine silk and one inner layer of atraumatic® No. 00 chromic catgut. The mesentery was approximated with interrupted fine silk. The resection and anastomosis were carried out through viable bowel, and good pulsation was ascertained in the mesentery. (Fig. 3.) The peritoneum was closed with continuous No. 1 chromic catgut. Interrupted heavy silk retention sutures were next placed 1 inch apart embracing all the layers of the abdominal wall except the peritoneum. Fascia and musculature were approximated with interrupted No. 1 chromic catgut. The skin was approximated with interrupted fine silk. One Penrose drain was inserted in the left subdiaphragmatic space.

Pathologic report revealed the following: The gross specimen consisted of a resected jejunum measuring 45 cm. in length and presenting a very extensive reddish black discoloration with gangrene of the intestine. The gangrene involved most of the specimen except

the terminal 6 cm. and the proximal 4 cm. where the intestine had a more nearly normal appearance. In these areas the intestine measured 3 cm. in diameter as compared with 5 cm. in the gangrenous portion. On cut section the lumen of the intestine was filled with thick,

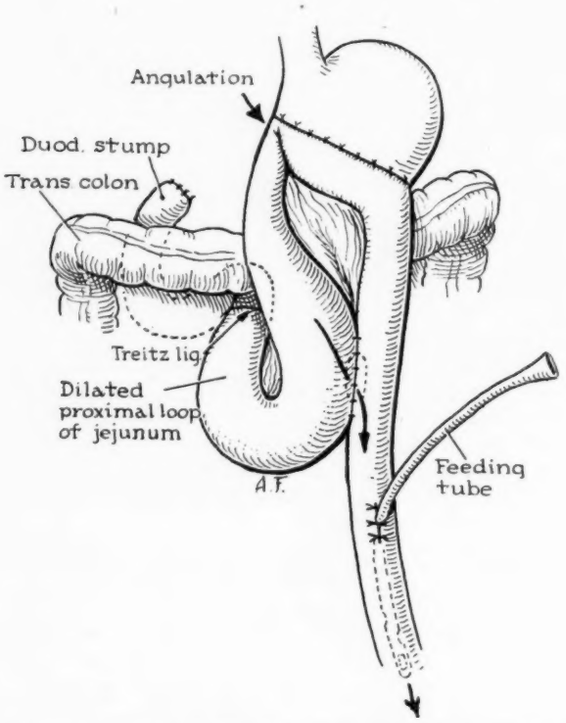

FIG. 4. Case II. Drawing showing operative findings and procedure at second operation. Note obstructed, distended, "water logged," proximal loop filled with bile and pancreatic juice compressing distal loop. Note side-to-side anastomosis between distended proximal and collapsed distal loop. Note jejunostomy with catheter inserted well into the distal loop for feeding.

red, foul-smelling blood. The entire wall of the gangrenous area was reddish black in color, thickened and hemorrhagic. In addition, the mucosal folds were either completely obliterated or flattened. There was a sharp line of demarcation between the gangrenous area and the normal jejunum. No tumor mass was encountered anywhere in the involved segment of intestine. The blood vessels of the mesentery were tensely engorged.

Microscopically, the wall of the small intestine was tremendously thickened due to very extensive hemorrhage within its wall involving all layers. The mucosal glands were still intact and stained well. The submucosal portion was markedly hemorrhagic and edematous. The serosa revealed an intense engorgement by recent blood cells and many of the venules were extremely dilated. There was no evidence of any intrinsic neoplasm of the intestine.

Section taken through the terminal portions of the intestine presented a very mild degree of hemorrhage and a normal histologic pattern.

Section through the mesentery revealed almost complete invasion by densely crowded red cells. The veins were tremendously engorged with blood and the adjacent arteries showed a similar picture but to a lesser degree.

Diagnosis was: (1) torsion and gangrene of jejunum; (2) gangrenous jejunum.

Immediately after surgery the patient was given nothing by mouth. He was placed in the Fowler position and received nasal oxygen. Continuous Levin tube suction was done. The patient was given 1 gm. of streptomycin twice a day and 300,000 units of penicillin three times a day. He received 500 cc. of blood the following day. His water and electrolyte balance were carefully watched. Recovery was uneventful and he was out of bed on the first postoperative day. His temperature and pulse returned to normal on the third postoperative day and remained normal until he was discharged on the eleventh postoperative day (January 26, 1952). The operative wound healed *per primam* and has remained well.

Follow-up on February 7, 1955, revealed that the patient was in good health with no dietary restriction, and doing well at the age of seventy-one.

CASE II. A fifty-seven year old man was admitted to the St. Francis Hospital on September 13, 1953, with the diagnosis of gastric ulcer. The patient gave a long history of stomach trouble. More recently he had had x-ray studies and gastroscopic examination. The diagnosis of gastric ulcer on the lesser curvature near the pylorus was established.

The past history was essentially negative except for diabetes mellitus for fifteen years and a "coronary episode" with positive electrocardiographic findings six months previously. His best weight was 174 but his present weight was 159. His mother had died from carcinoma of the stomach at the age of fifty-two.

Physical examination was essentially negative. Blood examination disclosed no abnormalities and the diabetes was controlled.

The patient's general condition was assessed and he was prepared for surgery. On September

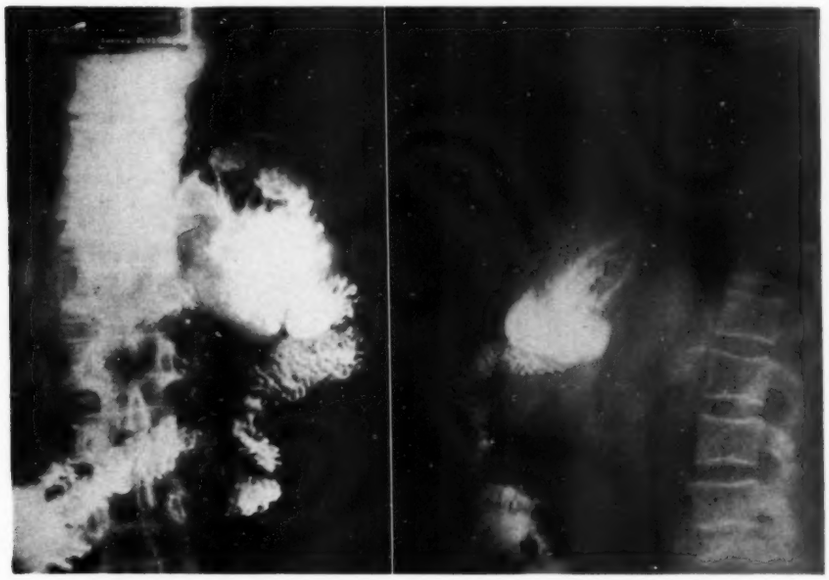

FIG. 5. X-ray films taken February 2, 1955, one year and three months after operation. Note small gastric remnant with good functioning stoma and slight dilatation of the distal (efferent) loop. The proximal loop and enteroanastomosis are not visualized. At the end of four hours all of the barium is within the small bowel just entering the colon.

15th exploration was done through a left upper paramedian incision. General abdominal exploration was negative. A small circumscribed ulcer approximately 1 inch in diameter was found on the lesser curvature of the pylorus. Although the lesion was freely movable and did not extend through the peritoneal coat, there was a suspicion of malignancy; hence, high subtotal gastrectomy was performed. A portion of the gastrohepatic and almost all of the greater omentum were removed with the stomach. An antecolic, antiperistaltic, Pólya type of anastomosis was made (distal loop to the greater curvature and proximal loop to the lesser). The jejunal loop was brought up and attached to the stomach in the manner described heretofore because it appeared to lie easier and more naturally in this position. (Fig. 4.)

The pathologic diagnosis was primary carcinoma of the stomach.

The patient did well after operation; the first eight days were uneventful. The Levin tube was removed on the third postoperative day and oral feedings were well tolerated. Late on the eighth postoperative day the patient complained of abdominal discomfort. He became nauseated, had abdominal pain with distention, and regurgitated gastric contents. A Levin tube was inserted. On the eleventh postoperative day gastric retention and regurgitation became more persistent. The patient's temperature rose to 101°F. and the pulse was 100. Eight hundred cubic centimeters of nonbilious gastric contents were recovered through the Levin tube. A tender mass could be palpated in the right side of the abdomen. The abdomen was silent. An x-ray film showed no evidence of obstruction or free air in the peritoneal cavity. A diagnosis of proximal loop obstruction was made and exploratory laparotomy was performed.

Under local anesthesia a supraumbilical midline opening was made. The proximal loop was found tremendously dilated and compressing a collapsed proximal loop about 8 inches below the gastric stump. (Fig. 4.) A rapid side-to-side anastomosis between the proximal and distal loops was performed utilizing one outer layer of interrupted fine silk and one inner layer of atraumatic No. 00 chromic catgut. A jejunostomy tube for feeding was well inserted in the distal loop with a double purse-string suture of atraumatic No. 00 chromic catgut. (Fig. 4.) The procedure was life-saving. The patient gained strength very rapidly. The jejunostomy tube worked its way out on the ninth postoperative day and the patient was

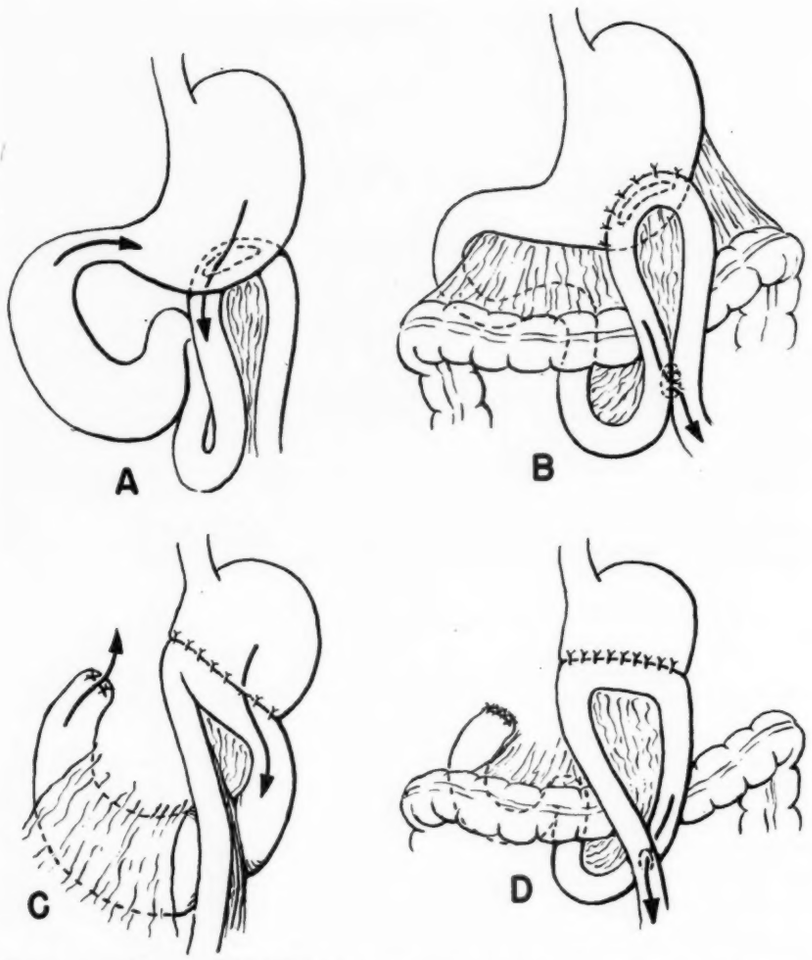

FIG. 6. A, vicious circle following gastroenterostomy. B, note how an enteroanastomosis corrects this situation. C, compression of proximal loop by mesentery of distal loop. D, enteroanastomosis prevents this complication.

tolerating a full diet. He felt well and was discharged on October 6th, eleven days after the enteroenterostomy and jejunostomy. He continued to make excellent progress at home, gaining rapidly in weight and strength.

On follow-up on February 15, 1955, the patient was actively engaged in a large business. He was symptom-free and had gained 24 pounds. He had no dietary restrictions other than that for his diabetes, which was well controlled.

Films taken on February 16th showed no abnormalities. (Fig. 5.)

COMMENTS

The persistent and severe types of proximal loop obstruction can become very serious if not recognized early and treated promptly. Yet a simple side-to-side anastomosis between the proximal and distal loops will correct the obstruction and prevent the hideous syndrome of closed loop obstruction. Although this mechanical complication can be avoided in part by retrocolic anastomosis, there are other more serious complications associated with this type of anastomosis, especially following high resections. The antecolic "hook-up" is therefore more commonly employed.[3,4,6–10]

The routine attachment of the proximal loop to the greater curvature and the distal loop to the lesser (isoperistaltic) has many strong advocates because it creates no torsion of the mesentery.[3,4,8–10] However, this is not the sole factor in obstruction. (Figs. 6 and 7.) The proximal loop may become obstructed by kinking if it is too short,[7,9] or it may angulate and kink if it is too long due to the weight and size of the "water-logged" loop. (Fig. 4.) The

Obstruction of Proximal Jejunal Loop after Gastrectomy

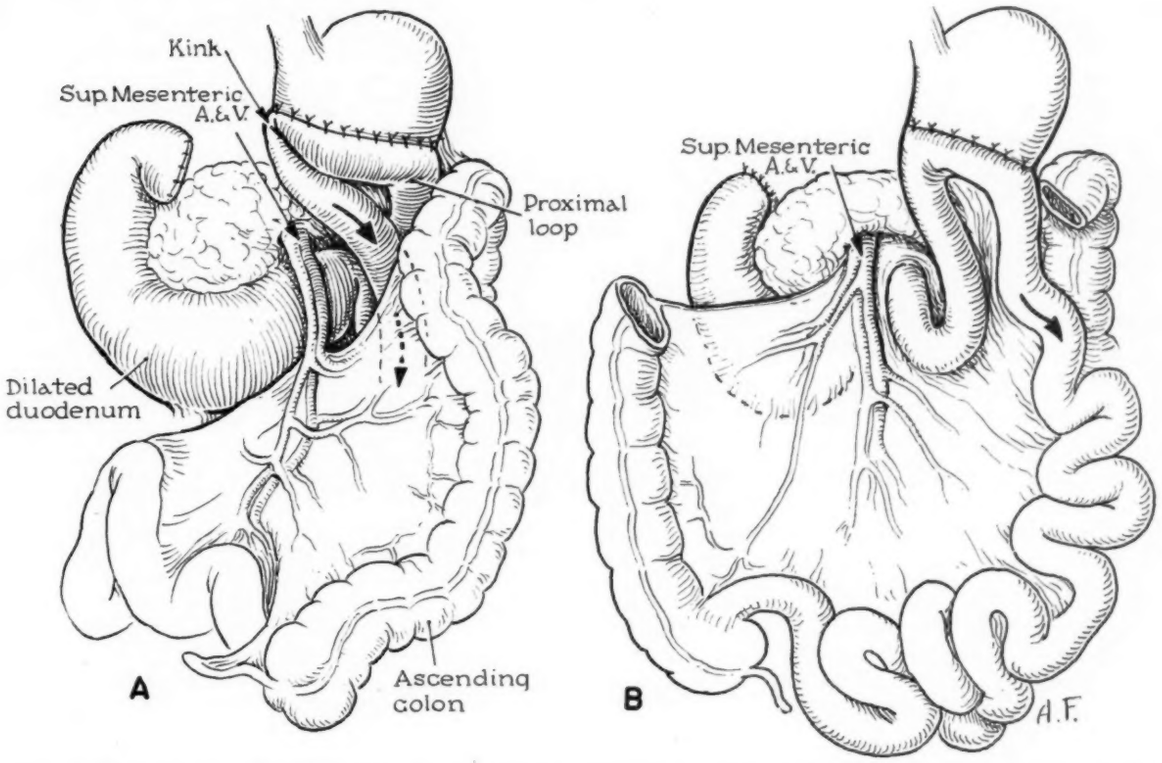

FIG. 7. Note the constricting power of the superior mesenteric vessels and the mesenteric attachment which crosses the last part of the duodenum. A tense mesentery compresses the duodenum against the vertebral column and can produce complete obstruction. Tension on the mesentery and the mesenteric vessels may be brought about by the drag of a heavy mobile cecum (A) or by loss of fat sufficient to permit the small bowel to drop into the pelvis (B). This tension in rare cases is sufficient to obstruct the intestine at the ligament of Treitz and produce more or less marked obstruction with dilatation of the duodenum.[11,23] Note in (A) how the distal loop can kink at the anastomosis and also obstruct the proximal loop by the drag and tension of the mesentery, even in an isoperistaltic anastomosis. Enteroanastomosis prevents this complication.

effects of retention and distention of the duodenal or proximal loop have been emphasized by many surgeons.[6,7,9] Even those performing the posterior "hook-up" have had trouble with the proximal loop.[3,4,6,8] One must realize that the normal duodenal content of the bile and pancreatic juice and secretions of the duodenal mucosa are roughly 1,500 cc. in twenty-four hours. With this quantity of fluid pouring into a loop sutured at one end and its exit interfered with at the other, dangerous distention and intraluminal abdominal pressure results. Much has been written on the importance of stagnant duodenal fluid in the genesis of postoperative complications.[3,4,5,7,11–13] Why not establish a supplementary enteroanastomosis routinely after gastric resection?

Such an anastomosis after gastric resections of the Pólya or Hofmeister type has a very definite advantage. Some surgeons employ it only occasionally because of the theoretic objection to the performance of enteroenterostomy which sidetracks the duodenal contents from the gastric stump. It is worth noting, however, that large amounts of bile and pancreatic juice are not well tolerated in the stomach.[14]

Moreover, no one knows whether acid is the *sine qua non* it is supposed to be in the cause of ulcer. The "no acid, no ulcer" dictum first proclaimed by Schwarz over forty years ago has recently been brought into question. Boles and Westerman write: "The devotion of the acid advocates to their cause must be admired when one contemplates the heartbreaking futility that has been so consistently encountered through the years in an attempt to eradicate ulcer by eradicating acid."[15] Moreover, the figures for gastric juice acidity after partial gastrectomy with and without short-circuiting anastomosis are certainly not convincing.[19] In fact, Starlinger[17] saw fewer marginal ulcers following the Billroth II or

Pólya type of procedures with accompanying anastomosis than without enteroanastomosis. He noted a 2.2 per cent incidence of marginal ulcers in 138 resections without accompanying enteroanastomosis, and 0.5 per cent in 2,292 cases in which the Billroth II type of procedure was supplemented with enteroanastomosis. One certainly cannot ignore these statistics.

In January, 1955, Nissen wrote: "For twenty years I have supplemented every gastro-entero-anastomosis following resection for ulcer by entero-anastomosis mainly in order to unburden the suture line of the duodenal stump. Our incidence of jejunal peptic ulcers has been 1.2% which compares favorably with the incidence of surgeons who oppose the performance of this additional anastomosis."[18]

SUMMARY

Much has been written about obstruction of the outlet or distal loop following gastrectomy. However, the complication of proximal or duodenal loop obstruction has received very little discussion and is therefore not generally known. Although obstructions of the distal or efferent loop may be well tolerated by patients for long periods with proper water and electrolyte balance, obstructions of the proximal loop result in a closed loop or potentially strangulating obstruction and are very poorly tolerated. Patients in whom this complication develops can die from hyperthermia thirty-six to seventy-two hours postoperatively. The syndrome has been reproduced experimentally.[20] This serious and often rapidly fatal complication can be avoided.

The proximal loop should not be too short to prevent kinking and rotation at the stoma. On the other hand, the proximal loop should not be too long because it may become "waterlogged" with bile, pancreatic juice and duodenal secretions. The heavy, distended loop can thus kink at the stoma and likewise obstruct the distal loop. Since it is almost impossible always to estimate the correct length of the proximal loop and to avoid tensions and torsions at the stoma, a supplementary enteroanastomosis should be established after the resection as an added safeguard. It serves the important function of evacuating the proximal loop and relieves pressure within the duodenum and on the duodenal stump. It is a useful but neglected procedure.

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Paraphysial Cyst of the Third Ventricle

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THE case reported herein is believed to be the first one in which pneumographic study revealed a paraphysial cyst that was filled with air from below. Pre- and postoperative serial air studies will be presented to illustrate this case, in which a paraphysial cyst (5.5 by 5 by 4.5 cm.) was removed with complete recovery of the patient.

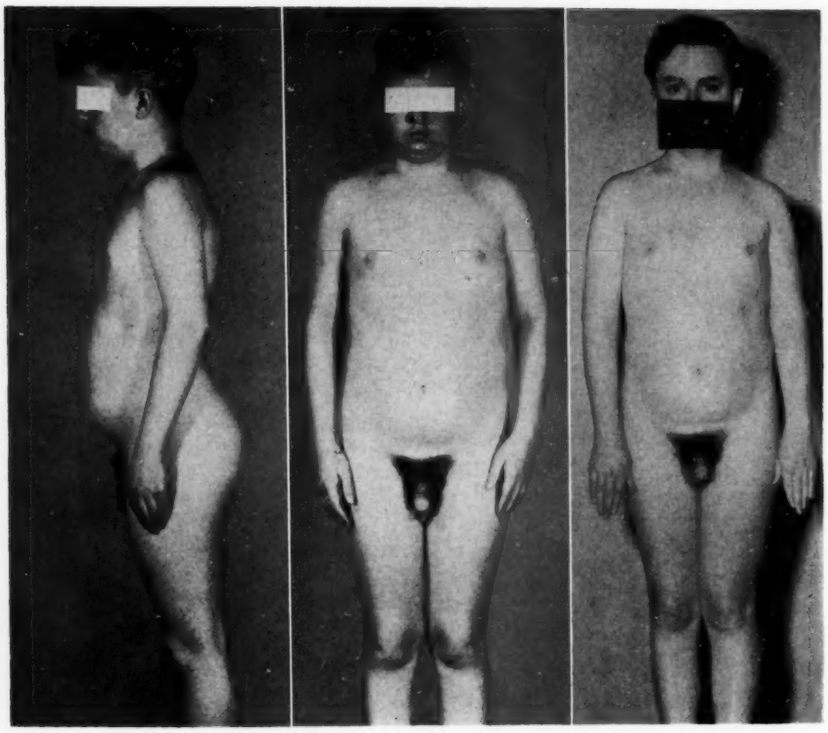
CASE REPORT

J. P. (U-24491), a fourteen year old boy, was admitted to Cleveland City Hospital on April 12, 1954, with the chief complaint of blurring of vision of three years' duration. In 1948 he had been struck by a slow-moving motor vehicle which threw him to the pavement with sufficient momentum to cause his body to roll 10 feet to the adjacent curb. It was uncertain whether there was any loss of consciousness. Physical examination at a nearby hospital was normal and the patient was discharged.

In 1950 he demonstrated marked behavior changes. He ran away from home frequently in the middle of the night, although he always returned in several hours. He told other people that his parents were dead and carried away objects from his home to present to his friends in the hope (according to his mother) of endearing himself to them. In 1951 several psychiatrists were consulted but made no definite statements to the parents after interviewing him. In 1952 he was sent to a juvenile research project in Columbus, Ohio, for investigation of his odd behavior. On routine physical examination he was found to have optic atrophy and blurred vision, and was referred to the University Hospitals in Columbus, Ohio, where after preliminary air studies, transfrontal craniotomy was performed on September 30, 1952. A cyst of the third ventricle was identified and drained through a pituitary approach along the sphenoid ridge. At this time it was ascertained that the cyst contained clear colorless fluid, but no attempt was made to remove it because it was not believed that the patient would tolerate further surgery at that time. He ran a very stormy postoperative course and it was not until one week postoperatively that he regained consciousness. He gradually improved and was discharged on October 18, 1952. Outpatient and hospital visits in Columbus continued to show severe bilateral optic atrophy; visual fields showed enlargement of the blind spots with some generalized contraction of the visual fields. Repeat air and dye studies showed continued evidence of blockage in the third ventricle. The cerebrospinal pressure measured in the ventricle was 200 mm. of water. Evaluation at Children's Hospital in Columbus in January, 1953, again revealed slight increase in intracranial pressure. His vision was recorded at this time as 20/40 in the right eye and 20/20 in the left eye. There was still marked right optic atrophy and slight esophoria in the left eye. He continued to have infrequent mild headaches as well as intermittent visual blurring. He did poorly in school after having been in the upper half of his class through the age of eleven years. His mother stated that his memory was poor for recent events, and that at times he tended to be slightly lethargic, slept excessively and fatigued easily. He was lost to follow-up in Columbus after January, 1953. In March, 1954, he was referred to Cleveland City Hospital because of poor vision which was noted by the school physician.

The patient is the oldest of three children and the mother stated that his childhood development had been superior to his siblings.

Physical examination revealed the following data: blood pressure, 112/72; pulse, 60; respirations 16; temperature, 37°C. He was a rather short, fourteen year old white boy whose secondary sexual characteristics seemed to be developing at a low normal rate. His hands and feet were small and thin. He looked younger than his stated age. (Figs. 1 to 3.)



1A 1B 2

FIGS. 1A and B. Lateral and frontal view of patient preoperatively to show moderate obesity but normal genitalia.

FIG. 2. Postoperative photograph (note eyes in primary position).

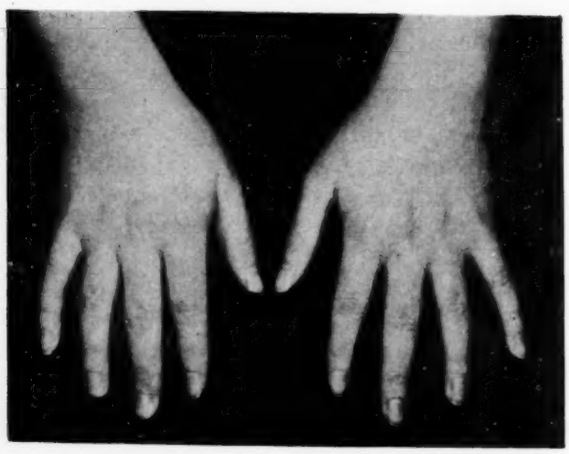


FIG. 3. Close-up to show long, delicate, tapering fingers.

Neurologic examination disclosed evidence of bilateral frontal trephination and a right transfrontal craniotomy incision, an osteoplastic flap and primary optic atrophy.

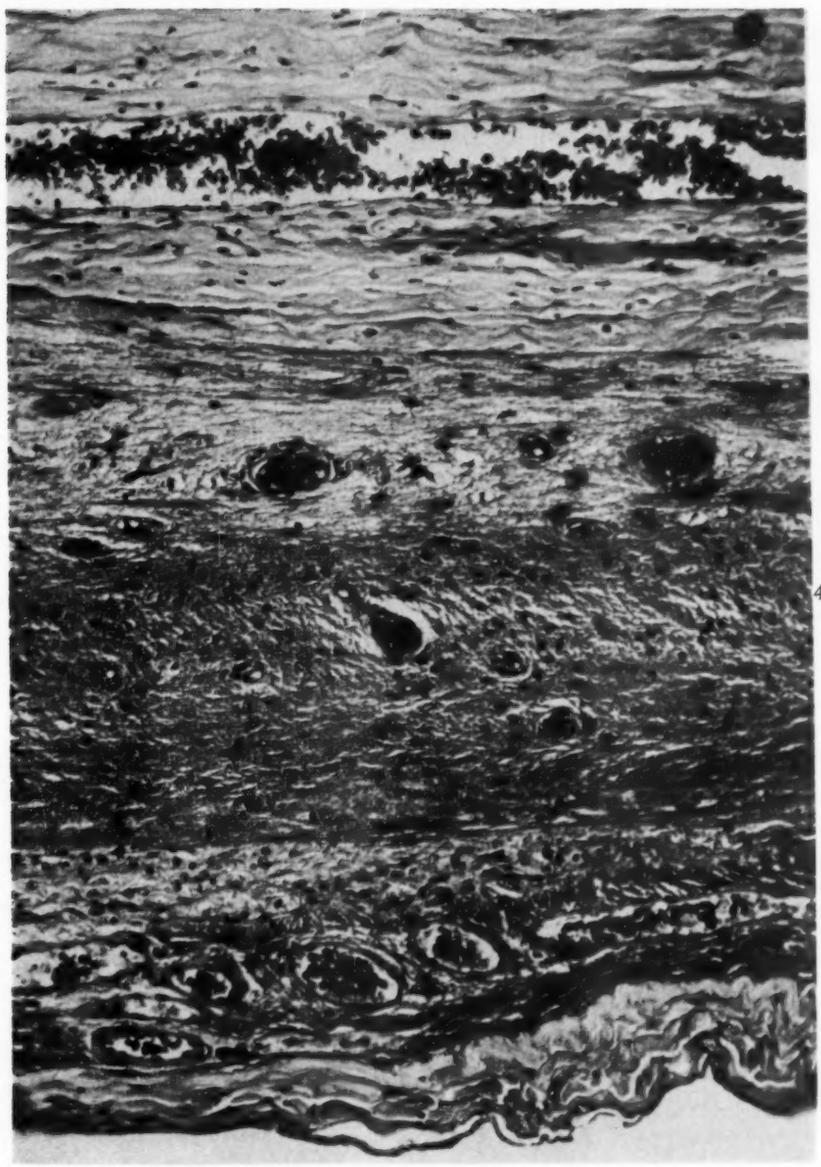
The blood chemistries, glucose tolerance and Thorn tests were normal. Basal metabolic rates (May 18, 1954) were minus 15 and minus 11. Cerebrospinal fluid examination (April 19, 1954) disclosed a protein value of 10 mg. per cent in the right ventricle and 90 mg. per cent in the lumbar subarachnoid space.

On April 26, 1954, through a right frontal transcortical incision, a large grayish blue cyst could be seen in the lateral ventricle. The wall was very firm and fibrous and measured from .5 to 2.5 mm. in thickness. The cyst dissected free easily except at two points, namely, the roof of the third ventricle where it seemed to be attached and at the inferior end of the cyst cavity where several bleeders were encountered which were controlled by cottonoid packing. The dilated ventricular system was reinflated with saline before closure was made.

Immediately after operation the patient ran a high fever (40° and 41°C.) and was quite lethargic, which was undoubtedly hypothalamic in origin. Postoperatively he walked with some hesitation, probably due to generalized weakness. He had temporary urinary and fecal incontinence. His memory was still very short and he had an inversion of his sleeping habits.

Postoperative external deviation of the right

4A



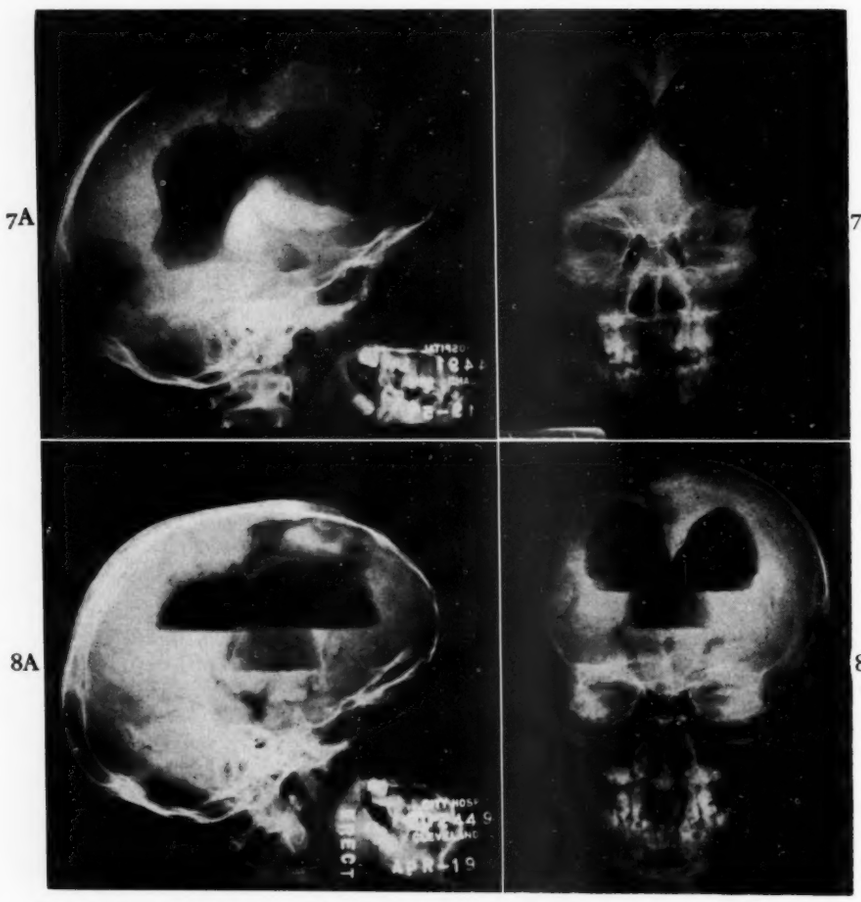
4B

FIGS. 4A and B. A, photomicrograph of wall of cyst near its attachment (original magnification × 5). B, photomicrograph of wall of cyst. Note that no normal epithelium is present (original magnification × 50).

5 6A 6B

FIG. 5. Pneumoencephalogram taken in September, 1952. Lateral view of the skull shows a collection of air within a cystic structure. From this view alone, one cannot say anything about the ventricular system.

FIGS. 6A and B. Postoperative ventriculograms in the left lateral and anteroposterior views show dilatation of the lateral ventricles. The third ventricle is flattened and displaced posteriorly by a well defined soft tissue density. The aqueduct of Sylvius and fourth ventricle are in normal position and of normal size. The catheter tip extends from the right lateral ventricle through the septum pellucidum to the occipital horn of the left lateral ventricle.

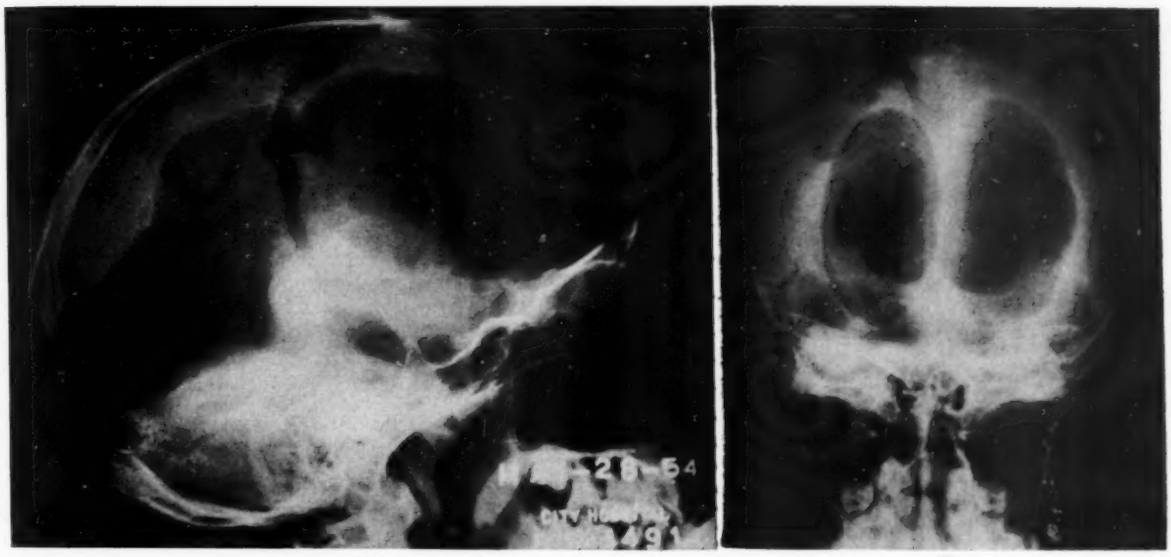


7A 7B

8A 8B

FIGS. 7A and B. Postoperative ventriculograms in the left lateral and anteroposterior views show dilatation of the lateral ventricle. A soft tissue mass is visualized in the region of the third ventricle. No air is seen in either the third ventricle, aqueduct of Sylvius or fourth ventricle. A bone flap is identified in the right frontoparietal area.

FIGS. 8A and B. Combined ventriculoencephalograms taken in April, 1954, in the erect position show dilatation of the lateral ventricles with filling of a cyst in the region of the third ventricle.



9A 9B

FIGS. 9A and B. Postoperative pneumoencephalograms taken in May, 1954, in the right lateral and anteroposterior views show dilatation of the lateral ventricles. The third and fourth ventricles are not identified. There is, however, no evidence of a soft tissue "mass" in the region of the third ventricle.

eye was cleared by December, 1954. He was fitted with bifocals because of lack of accommodation and is back in school doing satisfactorily. Neurologic examination is entirely normal. (Figs. 4 to 9B.)

SUMMARY

The radiologic criteria for the diagnosis of a paraphysial cyst of the third ventricle are all based on pneumographic studies. These have been summarized in detail by Bull and Sutton.[1] In none of the previously reported cases in which pneumographic studies are available has the cyst actually been visualized with air and fluid, as was done with the present case.

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Left Paraduodenal Hernia

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IN the performance of exploratory laparotomy for an acute abdominal syndrome the surgeon will encounter many unusual pathologic conditions. However, few are more striking than the bizarre anatomy of internal hernia. The surgical importance of a thorough understanding of the developmental and rotational anomalies which produce the anatomic distortions associated with these rare hernias has been emphasized, and excellent reviews of the pathologic embryology have been published.[1–3] The rarity of internal hernia is evidenced by the finding of only twelve cases over a ten-year period in a 3,500 bed charity hospital.[3]

A simple classification of internal hernias divides them into paraduodenal (left, right, transmesocolic and foramen of Winslow), pericecal, intersigmoid and internal supravesical. In a comprehensive survey of the literature up to 1939 Hansmann and Morton[4] collected 467 cases; of these hernias, 30 per cent were left paraduodenal in location. Paraduodenal hernia occurs three times as often on the left as on the right.

A case of left paraduodenal hernia encountered at laparotomy is presented for the purpose of illustrating the problems inherent in the diagnosis and treatment of this unusual condition.

CASE REPORT

A twenty-two year old white man (Hosp. No. 29 582) was admitted to the Surgical Service from the Outpatient Department on April 22, 1952, with a diagnosis of appendicitis. He complained that on the day before admission there had been a gradual onset of abdominal pain which was associated with anorexia and nausea. The pain was cramping in character, most marked in the periumbilical region, and had become progressively worse. He had had two loose bowel movements and had vomited four times during the twelve hours prior to admission. Dietary indiscretion was denied and systemic review was non-contributory.

Physical examination revealed a well developed, well nourished white man who appeared acutely ill; at intervals the patient would grimace with obvious pain and draw his legs toward his abdomen. His temperature was 97°F., pulse 90, respiration 20 and blood pressure 126/84. Pertinent physical findings were limited to the abdomen. Slight distention was present but a mass was not palpable. Diffuse tenderness, most marked in the periumbilical region, was present over the entire lower abdomen. There was spasm of both recti muscles. Bowel sounds were hyperactive. Rectal examination revealed marked tenderness bilaterally.

A white blood count was 19,700, with 86 per cent neutrophils. Urinalysis was normal. A plain roentgenogram of the abdomen showed no abnormalities.

Six hours after admission exploratory laparotomy under spinal anesthesia was performed through a mid-abdominal right rectus incision. On opening the peritoneal cavity a moderate amount of clear straw-colored fluid was seen. The appendix appeared normal. Approximately 2 ounces of thick reddish gelatinous cystic material was lying free in the cul-de-sac. The left side of the peritoneal cavity was occupied by a mass approximately the size of an infant's head; the mass consisted of small intestine enclosed in a smooth glistening sac. The mass was approximately 9 by 6 by 5 inches. Immediately distal to the duodenojejunal flexure the jejunum entered an orifice 1.5 inches in diameter. Approximately 9 feet of jejunum, dilated with gas and fluid to twice the size of uninvolved intestine, were delivered from the sac. The bowel was edematous and congested but definitely viable. There were no adhesions between the hernial contents and the walls of the sac.

The hernial space was found to be within the leaves of the descending mesocolon.

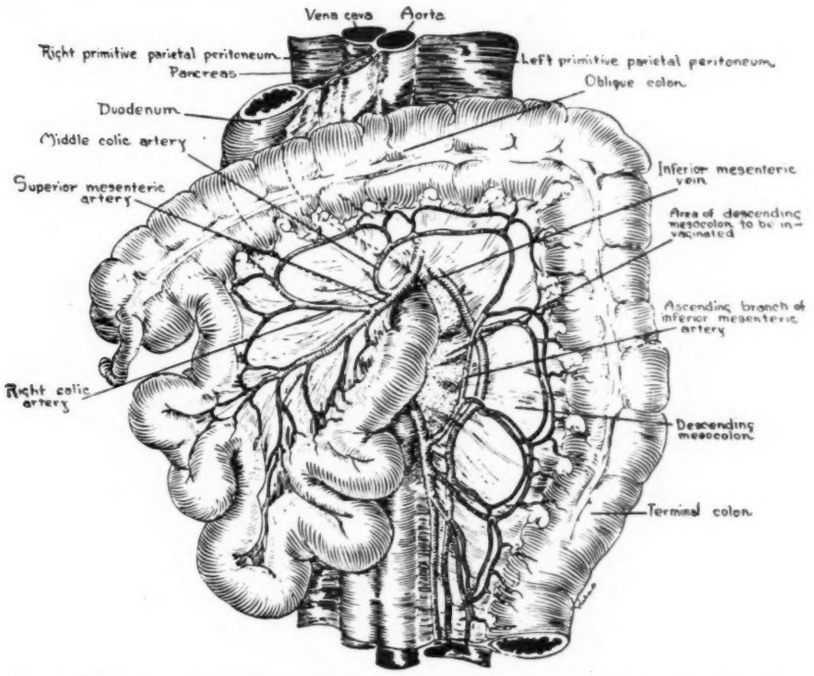

FIG. 1. Diagram of small and large bowel and their attached mesenteries in a stage of almost complete rotation; posterior peritoneal fixation has not yet occurred. The inferior mesenteric vein and ascending branch of the left colic artery run superiorly at some distance from the midline; the avascular area in the continuous transverse and descending mesocolon medial to these vessels is the area to be invaginated, according to the concept of Callender et al., by the coils of jejunoileum. (After CALLANDER et al. *Surg., Gynec. & Obst.*, 60: 1052, 1935.)

Laterally and inferiorly, the divergent leaves fused to form the mesocolon about 1 inch from the descending colon; the descending left colic branch of the inferior mesenteric artery passed laterally in the inferior part of the anterior wall of the hernia. Medially, the anterior wall fused with the posterior parietal peritoneum about 1 inch lateral to the root of the mesentery; the main branch of the inferior mesenteric vein and ascending left colic branch of the inferior mesenteric artery coursed medial to the hernial mass, and at the medial border of the hernial orifice passed superiorly deep to the posterior parietal peritoneum. The posterior wall of the hernia consisted of the posterior parietal peritoneum, indicating that herniation was entirely intraperitoneal between the leaves of the mesocolon. The free fold of the mouth of the sac was avascular, except at the medial edge, where the descending colic branch originated from the inferior mesenteric artery. The opening of the sac faced to the right.

A biopsy specimen was taken of the avascular free fold and the hernial orifice was closed by suturing the free fold to the posterior parietal peritoneum. Incidental appendectomy was performed and the abdominal wall was closed in layers.

Pathologic diagnosis of the cystic material removed from the cul-de-sac was "amorphous debris." The specimen consisted of variable-sized cysts with heavily congested fibrin walls containing coagulated protein with inflammatory round cells; culture was sterile. Layer differentiation of the sac wall specimen by microscopic examination was not possible.

The postoperative course was complicated by a wound hematoma which healed uneventfully following evacuation. A gastrointestinal series on May 6, 1952, was entirely normal. Follow-up examination one year later revealed that the patient was entirely well.

ETIOLOGY

The oldest concept of the genesis of paraduodenal hernia was advanced by Treitz[5] in

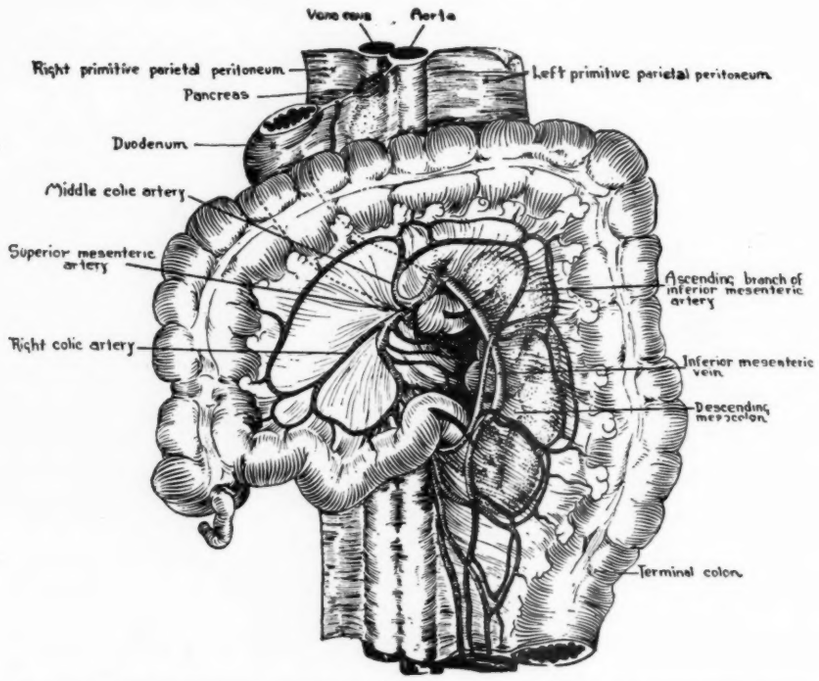

FIG. 2. Well advanced invagination of the as yet mobile descending mesocolon by coils of jejunoileum. The hernial sac is formed at the expense of the avascular area of descending mesocolon. The vascular trunks lie in the anterior wall of the neck of the sac. (After CALLENDER et al. *Surg., Gynec. & Obst.*, 60: 1052, 1935.)

1857. He gave an accurate description of the fossae about the duodenojejunal flexure and stated that cleavage in the various fossae by peristaltic movement of intestines could result in formation of retroperitoneal paraduodenal hernia. In 1923 Andrews[1] postulated that imprisonment of small intestine beneath the mesentery of developing colon as a result of malrotation was the probable underlying mechanism.

Callander, Rusk and Nemir[2] combined the essential features of both concepts, stating that invagination of an avascular and unsupported area of the mobile descending mesocolon during the embryologic migration of jejunum and ileum resulted in development of a "hernia into the descending mesocolon." (Figs. 1 to 3.)

Part or all of the small intestine may enter the sac. Since the inferior mesenteric vein and ascending branch of the left colic artery usually run superiorly at some distance from the midline root of the mesocolon (Fig. 1), there is a very considerable avascular interval, invagination into which (Fig. 2) will result finally in the location of these vascular trunks in the free fold of the hernial orifice. (Fig. 3.) These are the anatomic details most commonly described in left paraduodenal hernia.

If the inferior mesenteric vein and ascending branch of the left colic artery run superiorly close to the midline, invagination of the mesocolon lateral to these structures (Fig. 4) will result in posterior displacement of these vessels and avascularity of the free fold of the hernial orifice. (Fig. 5.) This concept most readily explains the anatomic features of the case presented in this paper.

DIAGNOSIS

The preoperative diagnosis of internal hernia is rarely made. Diagnosis was established prior to laparotomy or autopsy in only five of 140 cases of paraduodenal hernias collected by Longacre.[6]

An internal hernia has no characteristic symptoms and may be entirely asymptomatic until the general symptoms of acute small intestinal obstruction develop. The incidence of internal hernia in several large collected series of acute intestinal obstruction varies from 0.9[7] to 4.2 per cent.[8] Such an obstruction is strangulating in type in 62 per cent of cases

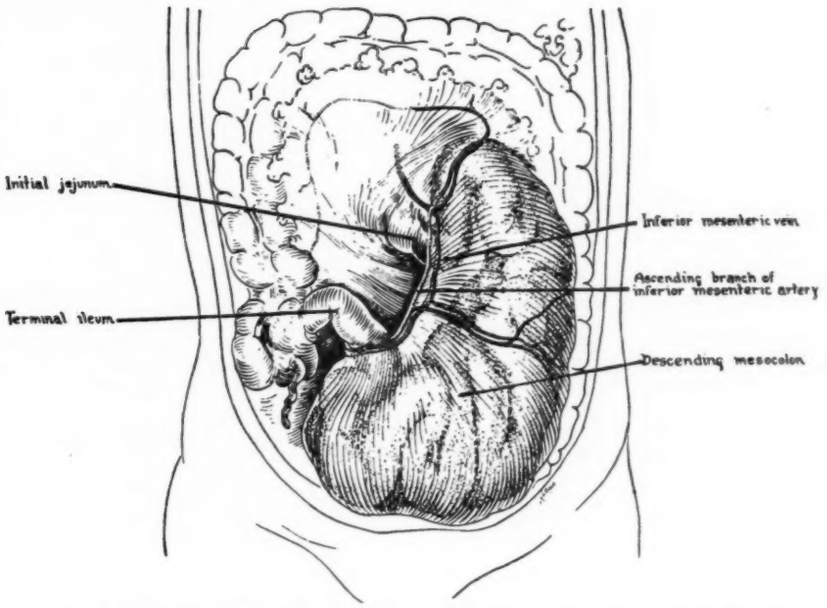

FIG. 3. Almost complete invagination of jejunoileum into descending mesocolon. This drawing depicts the anatomic features usually described in left paraduodenal hernia. (After CALLANDER et al. *Surg., Gynec. & Obst.*, 60: 1052, 1935.)

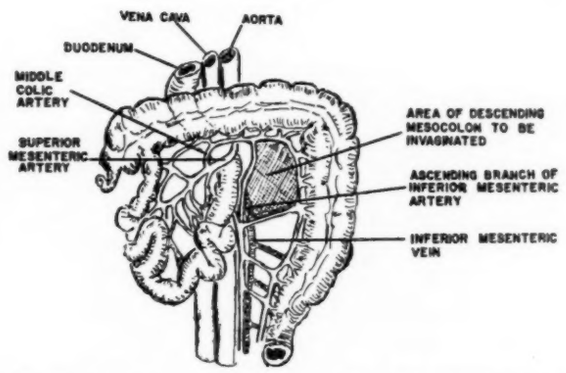

FIG. 4. Same stage as Figure 1. The main trunk of the inferior mesenteric vein and ascending branch of the left colic artery run superiorly close to the midline. The avascular area to be invaginated is lateral to these vessels.

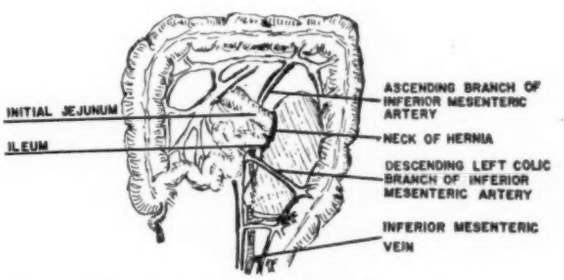

FIG. 5. Diagram of the condition found in the case presented herein. Attention is drawn to the vascular trunks which lie medial and then posterior to the hernial sac. The free fold of the neck of the sac is avascular. Compare with Figure 3.

according to Johnson.[9] Gangrene of the incarcerated bowel has been found as early as six hours and as late as eleven days following onset of symptoms.

Internal hernia enters the differential diagnosis whenever the clinical picture of acute small intestinal obstruction presents itself in a patient without external hernia who has not undergone previous surgery. The presence of a palpable mass, and/or an agglomeration of small bowel loops in one abdominal quadrant and their absence elsewhere on the scout roentgenogram, is very suggestive.[10] As with the majority of previously recorded cases, a correct preoperative diagnosis was not made in our case.

TREATMENT

The primary consideration in proper surgical care is the recognition of the basic anatomic features, especially the presence, identity and location of important blood vessels in or near the free margin of the hernial sac. Reduction of the herniated bowel and simple suture of the hernial orifice results in cure. If reduction cannot be accomplished readily by traction, release of the incarcerated intestine by incision through an avascular area of the anterior wall of the sac will facilitate manipulative reduction.

Intestinal resection is frequently required because of strangulation; such cases have a much graver prognosis, and approach a mortality of 50 per cent.[11]

SUMMARY

A case is presented of left paraduodenal hernia with unusual anatomic features. The mechanism of origin is briefly discussed, and the importance of familiarity of the abdominal surgeon with the basic anatomic features of internal hernia is stressed.

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Solitary Non-parasitic Cysts of Liver

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SOLITARY non-parasitic cysts of the liver are rather rare, only about 250 cases having been reported in the literature. Most of these are retention cysts of bile duct origin and are discovered only at autopsy. They are more predominant in the twenty- to fifty-year age group, and occur more often in the white race. They affect women four times as often as men.

These cysts vary in size from very small to one which was estimated to contain in excess of 17 L. The usual location is on the inferior surface of the liver near the gallbladder. They are mostly multilocular, which is a very important factor in planning treatment. The lining is ordinarily cuboidal and columnar epithelium.

Clinically these cysts produce vague, indefinite discomfort in the liver region when small, while the larger ones present a palpable mass. At times there is marked pain and some fever, associated with hemorrhage into the cyst. Occasionally there is an obstructive-type jaundice, probably due to mechanical pressure of the enlarging cyst on the large bile ducts.

We have had the opportunity to treat two of these cysts surgically: one was small and in a young woman, the other was quite large and in an old woman. These cases are reported in detail to show the inadequacy of certain forms of treatment and the advisability of more radical surgery when possible.

CASE REPORTS

CASE 1. A twenty-four year old white housewife was first seen in the office on April 2, 1951, with the chief complaint of pain in the gallbladder region of a few weeks' duration. There was no indigestion, no belching and no other symptoms referable to the intestinal tract. Examination at this time revealed a temperature of 99°F. and slight tenderness and rigidity over the gallbladder. Cholecystograms taken a few days later outlined a normal-sized gallbladder, no stones and normal emptying after a fatty meal.

On April 6, 1951, a definite firm mass was felt beneath the upper end of the right rectus muscle. It seemed that this mass was probably in the abdominal wall. External heat was prescribed and the patient was instructed to return for further examination. On April 23, 1951, a definite tumor mass was still present, apparently about 4 by 5 cm. in diameter and giving the impression of being about 2 cm. thick. There was no apparent motion on respiration at this time. Mild tenderness was present and the mass still seemed to be in the deeper layers of the anterior abdominal wall. Clinical impression at this time was desmoid tumor. A consultant agreed with this diagnosis and surgery was advised.

On May 2, 1951, the abdomen was opened through a long, upper right paramedian incision through the anterior rectus sheath, with transverse incision through the posterior rectus sheath and peritoneum. In the anterior inferior part of the liver, near the gallbladder, was a deep-seated, thin walled cyst measuring about 7.5 cm. in diameter. This reached almost to the posterior surface of the liver. No adhesions were noted. A decision was made to biopsy the cyst wall. Therefore, the cyst was opened, yielding a large amount of thin, watery, bile-tinged fluid. The cyst wall was found to be fairly tough and densely adherent to the liver substance. An attempt was made to dissect the cyst from the liver, but too much bleeding was encountered to warrant continuing. A wedge of cyst wall was removed for study and the cavity marsupialized by suturing the cut edges to the posterior rectus sheath. A large rubber tissue drain was inserted into the cyst cavity and the abdomen was closed.

There was considerable bile-tinged drainage for twenty-four hours. Forty-eight hours after surgery 20 cc. of 10 per cent formalin solution were instilled into the cyst cavity through a small catheter. This was productive of considerable upper abdominal pain which subsided in a few hours. The remainder of the postoperative course was entirely uneventful, and the patient was discharged on the fourth postopera-

tive day. Mild drainage continued for about two weeks and then stopped spontaneously.

Pathologic report of the specimen sent for microscopic examination showed "a curled 3.4 cm. flat portion of tan tissue. Liver tissue containing cystic structures with thick fibrous wall, and having a lining of cuboidal and columnar epithelium. This is apparently of bile duct origin and probably congenital. No evidence of parasitic disease."

The patient was last seen by me in December, 1951, at which time there was no sign of recurrence of the cyst. Attempts to have her return for further follow-up examinations were unsuccessful.

The remainder of her history comes from Dr. Claude Perry, of Anderson, South Carolina, who states that the patient consulted him on June 18, 1953, with the complaint of a lump noticed one week previously under the right rib margin at the site of the previous operation. She had experienced some discomfort in this general region for the past six to eight months, but had not been able to feel any mass until one week previous to examination. There had been no weight loss or disturbance of appetite or eating habits.

Physical examination at this time revealed a well nourished, well developed white woman who was not acutely ill, the only pertinent findings being limited to the abdomen. There was some tenderness and some muscle spasm over the old incision in the right upper quadrant. There was no tumor mass palpable either in the supine or upright position. Further physical findings were negative. In view of the past history, laparotomy was performed on June 27, 1953, by Dr. Perry, with findings, procedure and pathologic report described as follows.

At operation a cystic mass was found lying on the free margin of the right lobe of the liver, directly approximate to the interlobar fissure of the liver. The cyst had the size and general conformation of a distended hydropic gallbladder and was just to the right of the gallbladder. The mass appeared to be multilocular and not unilocular; there appeared to be no associated inflammatory process. The oblong mass extended inferiorly to just above the entrance of the hepatic vessels into the hilus of the liver. The stomach was normal to palpation and inspection. The gallbladder and biliary ducts were normal. In the pelvis, the uterus was of normal size and freely movable. The left adnexa were normal to palpation. The right adnexa were slightly cystic; however there was no large cystic degeneration of the ovary, the cyst present being only the size of a walnut. No other pathologic disorder was noted in the abdomen.

The abdomen was opened through a right thoracoabdominal incision. The abdominal portion of the incision was first made to determine the exact nature of the disorder and to discover whether it was a resectable lesion. Following the inspection of the abdomen it was decided that the lesion was resectable, and the thoracic portion of the incision was then extended across the rib margin into the seventh intercostal space. The thorax was opened and the diaphram was transected, giving an excellent exposure of the right lobe of the liver and the cystic mass on the free liver margin. The wound was then packed off. Staggered interrupted stitches were placed in the liver substance surrounding the cystic mass, and the mass was transected by sharp dissection in graduated stages. The most difficult portion of the dissection was at its inferior tip, approximate to the hepatic artery and portal vein. Some care was needed to prevent irreparable damage to these vessels. One large branch of the hepatic artery was necessarily transected. This was done in order to remove the tumor mass *in toto*. Following the completion of this dissection it was noted that the left lobe of the liver was slightly cyanotic and purplish in appearance. This lobe was observed during the rest of the operative procedure until it was found that it would finally recover. The blood supply of the lobe was undoubtedly compromised to some degree when the large branch of the hepatic vessel was transected. Upon removal of the tumor mass the free margins of the operative wound were further brought together with running atraumatic® catgut suture, and on the right side of the dissection the gallbladder fundus was pulled over the cut surface of the liver. This made an excellent covering for same. At the uppermost portion of the V-type incision in the right lobe of the liver a square of gelfoam® was placed over the surface and held in place by interrupted sutures. Excellent hemostasis was obtained, and upon closure of the abdomen no anxiety was felt concerning the hemostasis. The wound was closed in layers with interrupted cotton sutures in the diaphragm and in the external

fascia. The skin was closed with interrupted vertical mattress sutures. A drainage tube was left in the right thorax and positive pressure was used during closure of the thorax. The patient was returned to her room in good condition.

Pathologic report of the liver revealed the following: Clinical diagnosis: hepatic cyst. Grossly the specimen consisted of a cyst measuring 7 by 4.3 cm. and weighing 125 gm. Shaggy, red adhesions and islands of brownish grey liver were attached to the capsule except over one surface where a zone measuring 6 by 5.5 cm. was covered by smooth, glistening peritoneum. The remaining area represented part of the cyst attached to the liver. Between the smooth and rough parts of the capsule a length of falciform ligament measuring 5.5 by 1.5 was seen. There were three bosselations. The falciform ligament was attached to the largest bosselation which measured 5 by 4.5 cm. The upper end of the falciform ligament ended at a smaller bosselation which measured 3 cm. On section there were six loculi which were smooth-lined and contained light grey, semi-syrupy fluid. The loculi showed trabeculation over which there were smooth, glistening membranes. All of these cysts were contained within one capsule as previously described. In the wall of one of the cysts there were a number of small cysts ranging from 0.1 to 0.6 by 0.3 cm. Search of fluid which contained some yellow flakes from one of the cysts was negative for scolices. Phagocytic foam cells were seen, plus occasional polymorphonuclear leukocytes.

Microscopically a section through the septum between two cysts showed numbers of ductules which were lined by columnar epithelium. The nuclei of these cells were situated below the mid-zones. The apical portions contained globules of secretion. The stroma was fibrillar to fibrocellular. Lymphocytes were sprinkled irregularly in the tissue. Along one border there was granulation tissue which was infiltrated by polymorphonuclear leukocytes, lymphocytes and monocytes. There were areas of hemorrhage. This tissue showed nothing unusual. Attached to the wall of the cysts there were liver cord cells that were separated by loose vascular tissue in which there was hemorrhage. Larger masses of liver tissue showed sinusoids which were fully distended by red cells.

The diagnosis was bile duct retention cyst of liver. Such cysts are developmental. They are sometimes associated with congenital cystic kidneys. Some of the cyst walls showed fairly active inflammatory reaction and there were inflammatory cells sprinkled in the fibrous scar tissue about the cyst and in the supporting tissues of the liver attached to the cyst. The cyst was benign.

The postoperative course was uneventful and the patient was discharged on the sixth postoperative day.

She was seen again in January, 1954, at which time abdominal examination was normal and the patient free from symptoms.

Case II. A small seventy-two year old Negro woman was referred for treatment of a huge abdominal tumor. She was first seen in the hospital on January 27, 1953, with a history of increased growth rate of a large abdominal tumor of six months' duration. The patient appeared old and feeble, and her past history was sketchy. She had noticed a large abdomen for years, but only in the past six months had the size caused discomfort. There was moderate dyspnea on mild exertion. Activity was limited to trips to the bathroom, and these with help and with difficulty.

Examination revealed the following: blood pressure, 120/70; temperature, 98.6°F.; hemoglobin, 12 gm.; albuminuria; skin, smooth; heart and lungs, normal. The abdomen was distended to the size of a basketball with a tense non-tender cystic tumor filling the abdomen and apparently not extending into the pelvis. Due to the age of the patient pelvic examination was omitted.

On January 30th the patient was taken to surgery. Under sodium pentothal® ether-oxygen anesthesia a midline incision extending above and below the navel was made. A thin-walled cystic mass was seen completely filling the abdomen. Stretched over it was the falciform ligament. The cyst was punctured and emptied. It could then be felt to arise from the lower edge of the liver. On elevating the cyst sac the gallbladder was seen posteriorly, it was normal, thin-walled and free from stones. The stomach then descended behind the cyst. The liver was smooth and soft, and of normal consistency. Due to the poor condition of the patient no further exploration was performed. Excess portions of the cyst wall were removed and suture ligatures were placed around the

periphery. The cyst was marsupialized by suturing the cyst wall to the peritoneum in the upper end of the incision using No. 0 chromic catgut. A large Penrose drain was placed in the cyst cavity and the remainder of the incision was closed in layers. During the operation 500 cc. of citrated blood were given. The patient was returned to bed at 8:50 A.M. in fairly good condition. About 10:00 A.M., while reacting, she became very dyspneic and started to cough up white, frothy material. She was immediately given .6 mg. of crystodigin® intravenously, plus morphine and atropine, and the head of the bed was elevated. Pulse was 120, full and regular. In about two hours the condition was much improved. The remainder of the postoperative course was uneventful. There was profuse bile-tinged bloody drainage for ten days. Two weeks postoperatively 2 per cent solution of formalin was injected into the cyst cavity and the drain removed. The capacity at this time was judged to be about 50 cc. This solution produced severe pain in the epigastrium for twenty-four hours. The following day the patient was discharged.

The pathologic report is as follows: "Pathological diagnosis, cyst of liver. Two membranous portions of grey tissue measuring up to 15 cm. in diameter. Sections show a fibrous cyst wall lined by cuboidal and columnar epithelial cells, and containing numerous duct-like structures deeper in the fibrous tissue which are identical with bile ducts. In addition, the wall contains several foci of liver parenchymal cells which in one place extended almost to the mucosal surface. This structure is histologically benign and probably represents a congenital anomaly."

On March 7, 1953, the patient was seen in the office. There was no further drainage and her general condition was good except for mild dyspnea and ankle edema.

Further follow-up on August 15, 1953, and in March, 1954, revealed an apparently normal abdomen with no evidence of recurrence of tumor.

COMMENTS

Various treatments have been used for the cure of these cysts, namely, excision, packing the cyst cavity, marsupialization, the instillation of formalin into the cyst, and more recently the formation of an anastomosis between the cyst and a hollow viscus. Obviously the procedure of choice is excision when this is feasible. We must be particularly aware of the fact that most of these cysts, although single, are multilocular. Therefore recurrences are inevitable unless every locule is obliterated. The first case presented herein shows an initial treatment failure from marsupialization plus the instillation of formalin. The smaller locules were evidently left intact; hence they continued to grow. In retrospect this cyst should preferably have been excised at the initial operation, but the rarity of these tumors makes most of us unfamiliar with the problem. We are apt to suspect ecchinococcus disease, which is only disproved by microscopic examination and by the subsequent recurrence.

In the second case, that of an elderly poor-risk patient, the treatment plan followed should be considered satisfactory and probably ideal. It is doubtful that this patient would have tolerated a more formidable procedure than the one carried out.

CONCLUSIONS

These rare cysts are usually diagnosed at operation. Treatment of choice should be excision when it is technically feasible and the patient is a good risk. Otherwise a less radical procedure should be selected.

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An Alternative Method of Bile Duct Intubation in Cholangiojejunostomy*

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THE reconstruction of biliary channels remains a difficult problem in abdominal surgery. For this reason many methods have been reported for the repair of a diseased or injured common duct. However, the many operations described are not so much in variance with one another as they are indications of the many different types of anatomic, pathologic and clinical differences that the surgeon is likely to encounter in such operations. Therefore it is desirable that the surgeon be acquainted with the different types of repair and that his judgment be flexible as to the indications for each method.

Among the more perplexing problems of this type of surgery is the question of the use of splints (rubber, plastic or vitallium® tubes) to support the anastomotic suture line postoperatively. Usually some type of hollow splint is used as a compromise measure of its advantages and disadvantages. The advantages are: (1) assured immediate decompression of the biliary tree through the hollow tube into the intestinal tract, and (2) early support for an adequate cylindric repair of the anastomosed structures. The disadvantages of such a tube include: (1) the inflammatory reaction of any foreign body, (2) later pressure necrosis on the suture line with its attendant constricting fibrosis, (3) the probability of late intraluminal plugging with the formation of obstructive calculi, and (4) the debilitating effects of external fistulization of biliary and intestinal contents contingent on methods necessary for the eventual removal of the tube from the abdominal cavity.

The purpose of this paper is to report a method of intubation of biliary-intestinal anastomosis wherein the advantages just enumerated were secured with the exclusion of the possible ill effects of prolonged intubation and external fistulization.

CASE REPORT

E. W. W., a thirty-eight year old white man, was admitted for the third time in one year to the Kadlec Hospital on December 7, 1953, for the relief of right upper abdominal pain. On previous admissions a diagnosis of chronic cholelithiasis proved by x-ray had been made, and surgery had been advised and refused. During the present illness of forty-four hours' duration the abdominal pain had been constant in the right upper quadrant and had been accompanied with waves of more severe colicky distress in the same area, radiating to the right back. Vomiting and retching were frequent. There was no history of jaundice, dark urine or light-colored stools. There had been no chills or subjective high fever. Objectively, the patient appeared in acute abdominal distress. The abdomen was soft except in the right upper quadrant where moderate rigidity was increased by voluntary spasm due to severe tenderness. There were no signs of jaundice. The hemoglobin was 15.5 gm., the red cell count 5,000,000 and the white cell count 19,200 with 67 per cent neutrophils. Analysis of clear amber urine showed no abnormalities. Laparotomy revealed severe acute cholecystitis in a distended gallbladder obstructed by numerous faceted stones. Cholecystectomy under pentothal®-curare anesthesia proceeded without difficulty. The common and hepatic ducts were visualized as moderately inflamed but normal in size and not obstructed, and were not opened. The cystic artery and cystic duct were ligated with silk and a drain was placed to the reperitonized gallbladder bed. Subsequent gross and microscopic examination of the removed specimen revealed "severe acute hemorrhagic and ulcerative cholecystitis superimposed on chronic cholecystitis."

During the first four postoperative days the abdominal drainage was frankly purulent. A bland soft diet was tolerated well and the temperature was only mildly elevated. From the

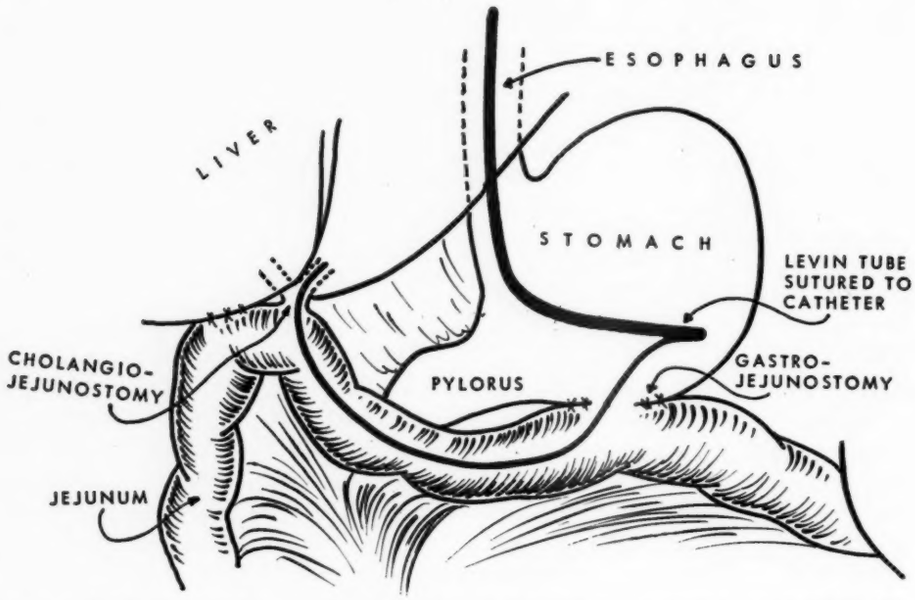

FIG. 1. Levin tube and attached catheter as used in the case reported, showing method of intubation.

fifth day onward the abdominal drainage became biliary in character. There were no other serious complaints. The patient was cooperative and tolerated intravenous terramycin,® intramuscular penicillin-streptomycin preparations and oral aureomycin without difficulty. Two 500 cc. transfusions were administered. The bile drainage continued to be profuse, and vitamin K and bile salt administration was continued. On the tenth to the fourteenth postoperative day oxycel® gauze was tamponed in the wound in an attempt to close the biliary fistula. This was repeated in the operating room under local anesthesia; the biliary fistula was curetted under local anesthesia, oxycel was buried in the wound, and the subcutaneous tissue and skin were closed using heavy silk sutures. Nevertheless, the bile drainage continued to be profuse, and despite this drainage marked jaundice appeared. By the fifteenth postoperative day it was apparent that more direct measures would be necessary to correct the biliary obstruction and the wound was reopened under spinal anesthesia. A third transfusion was given in the operating room.

Exploration revealed an enormous amount of vascular adhesions about the liver hilus and the hepaticoduodenal ligament. An abscess was encountered at the site of the cystic duct ligation in the midst of a thick fibrous mass. Incision of this area liberated free pus and a silk ligature. A raggedly transected bile duct of common hepatic duct size was encountered in this abscess. Despite several hours of exploration, including mobilization of the duodenum, no distal common duct was found in the mass of necrotic tissue. During the last hour of the procedure the patient's condition deteriorated rapidly and the blood pressure could not be sustained adequately with transfusion. Accordingly, it was decided to treat the most flagrant abnormality at least in a temporary manner and defer a more permanent procedure. The freely draining liver duct was trimmed back for a few millimeters and a loop of jejunum, approximately 20 cm. from the ligament of Treitz, was brought to it. A small opening was made in the apex of this loop and a rubber catheter was threaded into it. The eye of the catheter was then sutured with plain fine catgut into the stump of the common hepatic duct, and with this as a lever an anastomosis was made between this small duct and the jejunum. Since I feared the further effects of a debilitating fistula and, on the other hand, desired a means of removing the catheter without further surgery, the jejunum was again opened where the distal end of the catheter presented itself. An opening was then made in the greater curvature of the stomach and the distal end of the catheter was sutured with black silk to the sucking end of an indwelling Levin tube which

aspirated the stomach. Rapid gastrojejunostomy completed the operation and the abdomen was closed in one layer about a Penrose drain. In this manner the bile duct was anastomosed to the jejunum, and a catheter placed through the anastomosis freely drained the bile into the intestinal tract and could easily be removed by virtue of its connection with the Levin tube in the stomach. (Figs. 1 and 2.)

The postoperative course of this second operation was relatively smooth. Wangensteen suction immediately aspirated clear bile, indicating the free drainage through the biliary catheter. Aspiration and intravenous therapy were discontinued on the fifth postoperative day. The jaundice quickly subsided and the urine and stools resumed their normal color. Phenergan® troches adequately controlled the discomfort of the indwelling Levin tube which was left in place until the thirteenth postoperative day when it was removed, bringing with it the attached biliary catheter. The Penrose drain was removed two days later in order to drain any fistula which might occur following the removal of the indwelling tube through the cholangiojejunostomy. However, no further drainage occurred through the wound.

The patient was discharged, ambulant, eighteen days following his second operation. He was on a regular diet and his wound was healed; there was no jaundice, nor has there been any recurrence of jaundice, dark urine or clay-colored stools. A superficial infection of the abdominal wound was treated in the outpatient department. The patient returned to work ten weeks following his second operation, at which time he had regained 19 pounds of the weight loss (29 pounds) sustained throughout his illness.

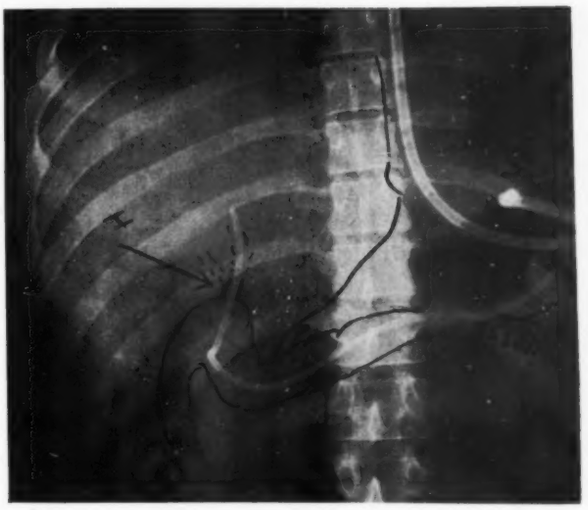

FIG. 2. X-ray taken seven days postoperatively showing connected tubes in place. Bile duct, stomach and jejunum drawn on x-ray for clarification. H = hepatic duct; P = pylorus; S = stomach.

COMMENT

Inflammation and necrosis of the common duct is an infrequent cause of acute biliary obstruction or chronic stricture. In the case reported herein liver bed bile leakage and the virulent organisms from acute ulcerative cholecystitis caused an abscess around the foreign body of the cystic duct ligature. The necrotic process caused purulent drainage from the wound until the duct was gradually destroyed, at which time the drainage changed to one of profuse bile. Although a portion of the distal duct may have escaped necrosis, it could not be found in the diffuse inflammation encountered at operation. Cole[2] has described this process but more often in relation to the late development of strictures. In my experience as operator or assistant in well over 500 operations on the gallbladder and bile duct only one similar instance of bile duct destruction was encountered as a result of necrosis, and this was in a prolonged severe case of acute hemorrhagic pancreatitis.[4]

The method of repair in this case made use of the available tissues and took into account the factors of the patient's emergency condition and the relative acuteness of the pathologic condition. A Roux-Y arm of jejunum was not used in order to save time and simplify the procedure. However, if such a procedure had been used, it is unlikely that such an intubation as described herein would have been attempted.

Regarding intubation, it is of interest to note that Cole[3] prefers not to utilize such a splint as he has observed a marked inflammatory reaction from these tubes causing extensive thickening and fibrosis in the reconstructed ducts. Walters[7] has also dispensed with such a splint when he believes the anastomosed duct is of large enough caliber. Longmire and Sanford,[6] in discussing intrahepatic cholangiojejunostomy, mentioned that an indwelling tube may on occasion cause jejunal erosion with intestinal bleeding and that it might also become a source of difficulty at a later time should it not be passed. Lahey[5] and Cattell[1]

use hollow splints and prefer to leave them in place for a long period of time. All investigators agree that no matter which tube is used, all " . . . unfortunately accumulate bile pigment within their lumen and they either must be made to pass from the anastomosis or removed surgically because they will all act as foreign bodies and obstruct the bile duct."[7] The method of intubation as described herein allows the surgeon direct control over the biliary catheter whereby he can utilize the early advantages of the splint without fear of external fistulization or the late disadvantages of such a prosthesis. In addition, the direct connection of the biliary catheter to the Levin tube permits immediate postoperative evidence that bile is flowing into the gastrointestinal system. It is apparent that the method described is contraindicated in any patient suspected of having coincidental peptic ulcer.

SUMMARY

1. The problems of biliary duct reconstruction are emphasized, especially in relation to the use of hollow tubes as splints to support anastomosed channels.

2. A case is reported of biliary fistula caused by acute inflammation, abscess and necrosis of the common bile duct.

3. An alternative method of bile duct intubation in cholangiojejunostomy is described which enables the surgeon to remove the indwelling catheter (by simple withdrawal) accurately and certainly when the advantages of its use may be terminated.

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Acute Pneumocholecystitis

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ACUTE pneumocholecystitis is a form of acute cholecystitis characterized by the formation of gas in the gallbladder. In some cases the gas may spread into the wall and even outside the gallbladder. The initiating factor is obstruction of the cystic duct, almost invariably by calculi. The formation of gas thereafter depends upon the presence within the gallbladder of gas-forming organisms and conditions favorable for their growth. The diagnosis can be established by the finding in the flat abdominal x-ray film of a radiolucent shadow within the gallbladder. In the upright position a fluid level within this radiolucent shadow can usually be demonstrated. Sometimes a halo of gas is found surrounding this shadow, and in advanced cases gas can be seen in the pericholecystic area. The location and pathways of spread of this gas have been experimentally demonstrated.[1]

Symptomatically, cases of acute pneumocholecystitis are not recognizable from ordinary cases of acute cholecystitis. Perhaps they are more prone to become complicated by gangrene, perforation and peritonitis. In spite of the frequent, but not invariable, finding of organisms of the Clostridium welchii group, the clinical course has not been as serious as gas infections elsewhere. Mechanical factors rather than bacteriologic factors seem to influence the course.

As in usual acute cholecystitis, differences of opinion exist as to the best management of acute pneumocholecystitis. Some authors have advocated non-surgical treatment, recommending intervention only for the complications. Others are more inclined to perform cholecystectomy or cholecystostomy because of the mechanical and bacteriologic considerations.

In 1948 Heifetz and Senturia[2] reported two cases of acute pneumocholecystitis and found eight other cases in the literature. A more careful investigation of the domestic and foreign literature now reveals that there were eighteen cases prior to this report, two were reported the same month and twenty-nine since then, making a total of fifty-one cases. Single cases have been reported in thirty-one publications.[3-32] Two cases have been reported by Heifetz and Senturia,[2] Kent,[33] Rothbart and Steinberg,[34] and Bell et al.;[35] three cases by McCorkle and Fong,[36] Stevenson,[37] and Schottenfeld;[38] and four cases by Friedman, Aurelius and Rigler.[39] The following is a description of another case, the fifty-second.

CASE REPORT

F. B., a sixty-nine year old white man, was admitted to St. Joseph's Hospital of St. Charles, Missouri, on November 14, 1948, two days after the onset of severe epigastric pain associated with persistent nausea and vomiting. There were no previous gastrointestinal complaints. Admission temperature was 100°F., pulse rate 94, white cell count 15,700, and there was a moderate shift to the left in the differential count. Marked tenderness in the upper right quadrant and epigastrium, and moderate localized rigidity and rebound pain were present. Jaundice was absent. There was a question as to whether the gallbladder could be palpated. A diagnosis of acute cholecystitis was made and non-operative treatment was started. A week later, when no improvement was noted, a scout film of the abdomen was taken. This showed an ovoid gas shadow within the gallbladder, and most of the wall of the fundus was outlined by a concentric ring of gas. (Fig. 1.) A diagnosis of acute pneumocholecystitis was then made. The surgeon chose to continue with conservative therapy. When there was no improvement, surgery was performed on November 29th, two weeks after admission. The gallbladder was greatly distended, acutely inflamed, tense, thick-walled and edematous. It was so densely adherent to surrounding organs that exposure of the duct area was considered inadvisable. When opened,

FIG. 1. Acute pneumocholecystitis. X-ray of abdomen showing gas within lumen of gallbladder. The arrows point to gas also within and outside the wall.

gas under pressure escaped. The contents also included numerous bilirubinate calculi and pus. Much of the mucosa was necrotic and had separated from the rest of the organ. Cholecystectomy was performed. Culture of the pus showed a gram-positive gas-producing bacilus of the Cl. welchii type. The postoperative course was uneventful, and the patient was discharged from the hospital on the twelfth postoperative day. Several days later when the cholecystostomy tube was removed the spontaneously separated necrotic gallbladder came out with it. The patient has since remained well.

SUMMARY

Acute pneumocholecystitis is a form of acute cholecystitis characterized by the formation of gas in the gallbladder. Fifty-one cases have been reported in the available world literature. An additional case is described.

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M. Newton compared results in fifteen patients with early cervical cancer treated with radiation followed by radium to the cervix, with a similar number of early cases treated surgically. The latter consisted of radical panhysterectomy, removal of parametria and of the upper part of the vagina, and excision of iliac and obturator lymph nodes. Newton found that twenty-six months afterward the survival rate and incidence of recurrence were alike. If further studies prove this to be true, one is justified in recommending the simpler though equally effective procedure, namely, radiation plus radium applied directly to the cervix uteri. (*Richard A. Leonardo, M.D.*)

Hydatid Cyst of the Liver

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Pittsburgh, Pennsylvania

From the Surgical Service of the Elizabeth Steel Magee Hospital and the Department of Surgery, University of Pittsburgh, Pittsburgh, Pennsylvania.

THE following report of a case of hydatid cyst of the liver is probably of more interest from a statistical standpoint than any other. It does not seem unreasonable to expect to find more of these cases, in view of the great number of people who in recent years have been in locations where they might acquire the disease.

CASE REPORT

F. L., a thirty-eight year old woman, was admitted to the Medical Service of the Elizabeth Steel Magee Hospital on August 20, 1953. Her chief complaints were backache, anorexia, a 14 pound weight loss in two months, pain in the lower left side of the chest, nausea and a mild non-productive cough. Her symptoms were of two months' duration. Two months before admission she had consulted her personal physician because of backache; the physician had not been able to relieve this complaint. Two weeks prior to admission she had pain in the lower portion of the chest accompanied with dyspnea and nausea when she lay flat. There was no vomiting, jaundice or change in bowel habits. Her past history was negative except for pneumonia seven years prior to admission. The family history revealed that the patient's mother had died at the time of her last pregnancy. The patient's father had died of cardiovascular disease. There were five siblings, all living and well. The patient was an Italian and had come to the United States thirteen years prior to her admission. Her family had raised pigs and goats.

Physical examination revealed a thirty-eight year old, well nourished white woman who apparently had some difficulty in breathing; there was rapid respiration but the patient's lungs were entirely clear. The outstanding physical findings were confined to the abdomen. The abdomen was rotund and the liver was markedly enlarged extending down to the umbilicus. It presented a smooth, tender mass which protruded both to the right and left, and moved with respiration.

The laboratory studies showed the following: red blood count, 4,430,000; white blood count, 9,100; hemoglobin, 12.9 gm.; neutrophils, 66 per cent; lymphocytes, 34 per cent. Urinalysis showed 1 plus albumin on admission. Blood chemistry showed non-protein nitrogen 28.3 gm. and sugar 83.3 gm. per 100 cc. The icterus index was 7.5. The total protein was 7.15 gm. per cent, albumin 3.70 gm. per cent and globulin 3.45 gm. per cent. The albumin-globulin ratio was 1.1–1.07. Phenolsulfonphthalein studies showed 30 per cent the first fifteen minutes, 35 per cent the first half hour, 25 per cent at one hour and 3 per cent at two hours, making a total of 93 per cent in the voided urine. A cephalin-flocculation test was zero. Serology was negative. Clotting time was 2 minutes, 50 seconds; bleeding time was 1 minute. The prothrombin time was 81 per cent. Serum alkaline phosphatase was 13.4 Bodansky units. Stools were negative for ova and parasites.

X-ray examination revealed the following: The lung fields were clear. There was elevation of both hemidiaphragms, especially the right, the result of increased intra-abdominal pressure. There was obliteration of the right costophrenic angle, the result of pleural organization. Gallbladder studies by oral cholecystography showed non-visualization of the gallbladder shadow. Gastrointestinal series was negative except for several flecks of calcium deposits in the right upper quadrant, probably within the liver. (Fig. 1 and 2.) The thoracic spine was negative.

At the time of admission and physical examination the resident made the diagnosis of hepatomegaly of undetermined etiology; parasites, amebiasis and echinococcus were to be ruled out. The attending internist and consulting

FIG. 1. Roentgenogram of abdomen. Mural calcification of wall of cyst.

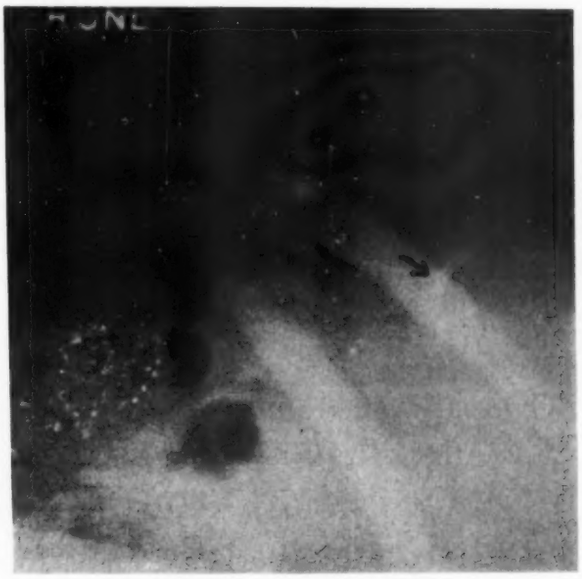

FIG. 2. Enlargement of calcification shown in Figure 1.

surgeon (H. E. F.) were either more cautious or less alert. Their impression was: (1) cyst of the liver of undetermined cause, and (2) possible pancreatic cyst. The latter impression was offered because of the severe backache of which the patient complained.

The patient was operated upon eleven days after admission to the hospital. The preoperative diagnosis was cyst of the liver. Spinal anesthesia and sodium pentothal were used. The abdomen was entered through a Kocher incision. When the peritoneal cavity was opened, a large amount of clear yellow fluid was encountered. The liver was markedly enlarged and congested. However, the enlargement was entirely confined to the right lobe. A soft, fluctuating area could be palpated over the right dome of the liver; this area was firmly adherent to the diaphragm but separated without difficulty. An aspirating needle was inserted at this point, and a small amount of mucoid material was obtained. The operative field was well packed off from the rest of the abdomen, and the cyst was opened and its fluid content evacuated by suction. The cyst was entirely filled with daughter cysts which were removed with a large gallbladder scoop. These cysts completely filled two emesis basins and varied in size from several millimeters to 4 to 5 cm. (Figs. 3 and 4.) The inner lining of the parent cyst was markedly irregular and inflamed. It was thoroughly cauterized with carbolic acid and alcohol. The cyst was marsupialized and packed with gauze, and the abdomen was closed. The patient withstood the procedure reasonably well and left the operating room in good condition.

Laboratory examination revealed the following: Grossly, the material removed from the cavity within the liver consisted of an estimated 2,000 cc. of opaque, grayish white, gelatinous cysts. The diameters of the cysts varied from a few millimeters to 4 to 5 cm. The cysts contained clear serous fluid, and in addition, some of the smaller ones contained minute particles which gave the fluid a darker turbid appearance, the so-called "hydatid sand." For the most part the walls were thin. Some cysts with thicker walls had a roughened, granular appearance to the inner lining.

Early microscopic sections from random cysts showed the typical amorphous laminated character of the wall of the cyst but failed to reveal scolices or hooklets. Both were easily demonstrated, however, when wet preparations were made from the sandy contents of one of the smaller cysts previously described. (Figs. 5 and 6.) Permanent sections through this same wall of the cyst revealed scolices with rings of hooklets in place.

Postoperatively the patient had an uneventful course; her temperature subsided in ap-

FIG. 3. A portion of the group of cysts removed from the liver.

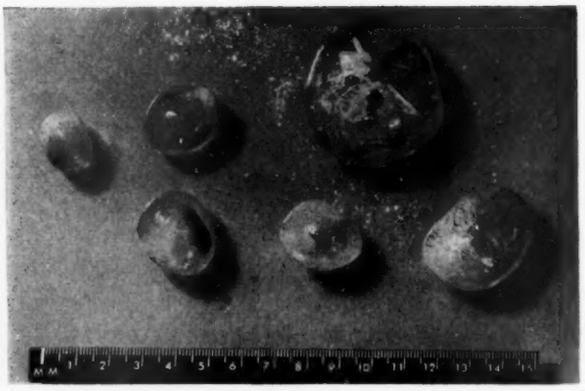

FIG. 4. Individual cysts.

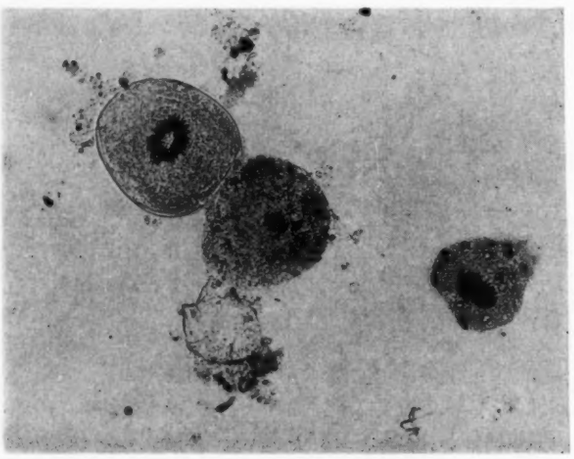

FIG. 5. Photomicrograph of scolices from cyst. Unstained, original magnification × 150.

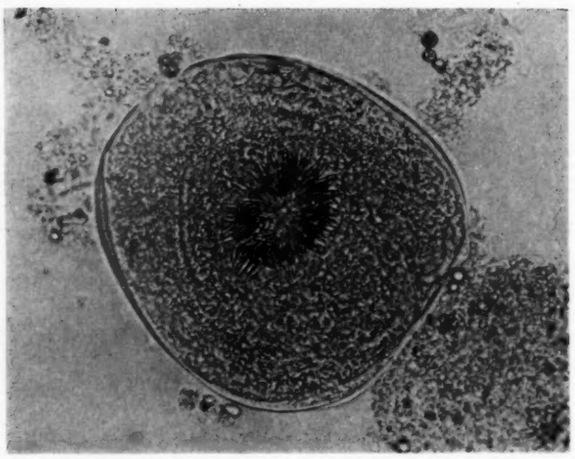

FIG. 6. Photomicrograph of single scolex. Unstained, original magnification × 450.

proximately forty-eight hours. She had vague complaints of numbness in her legs on two occasions and we were concerned about the possibility of other cysts, but these complaints were not accompanied with any neurologic findings and subsided rapidly. The packing was slowly removed from the cystic cavity and the patient was discharged from the hospital thirty-seven days postoperatively, at which time the wound was entirely healed. She has been seen at intervals since her discharge. When last seen seventeen months following operation, she had regained all of her weight, had no complaints and was carrying on her usual activities as a housewife.

COMMENTS

Arce[1,2] has presented two excellent articles on hydatid disease. He has pointed out that if one is faced with a hepatic or abdominal tumor of silent evolution in a patient coming from a zone where hydatidosis is endemic, a hydatid cyst must be suspected. He offered three aids to diagnosis: (1) eosinophilia; (2) Imaz-Lorentz complement fixation test; and (3) Casoni's test of the skin.

Arce further emphasized that eosinophilia is not a constant finding in hydatid disease, and pointed out that calcification is frequently seen. Complement fixation or skin tests were not done in the patient described herein. However, the clinical history of a patient who came to this country from Italy thirteen years prior to onset of her present complaints, whose family raised pigs and goats, and who presented herself with a large tumor of the liver showing areas of calcification, was sufficient evidence to entertain a possible diagnosis of echinococcus

cyst of the liver. Errors in the diagnosis of hydatid disease are frequent, probably because there is no consistent clinical picture. This variance in the signs and symptoms of the disease may for the most part be attributed to the multiple locations of the cysts. However, inaccurate diagnosis probably is more often due to failure to think of the condition rather than lack of evidence of the disease.

The treatment for this disease is entirely surgical at the present time. Arce offered four modes of attack upon the cyst: (1) removal of parasites followed by suturing of the adventitial tissue without drainage; (2) removal of the parasite followed by marsupialization and drainage of the adventitia; (3) removal of the parasites without suturing or drainage of the adventitia; and (4) total removal of the cyst. In the case presented herein the second mode of attack was utilized.

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Cardiac conditions and cholecystitis are occasionally confused; hence one should be especially careful not to perform cholecystectomy upon cardiac patients with a normal gallbladder. To operate upon the gallbladder of a patient with a recent myocardial infarction is especially dangerous, of course. On the other hand, "cardiac symptoms" can be produced by a diseased gallbladder; and when the gallbladder is removed, the supposed "cardiac symptoms" disappear. In those cases in which gallbladder disease is actually associated with a cardiac lesion, such as coronary sclerosis, the operative mortality may be as high as 10 per cent. It behooves all of us, therefore, to be especially sure whenever possible that the heart is all right before attempting cholecystectomy. (*Richard A. Leonardo, M.D.*)

BOOK REVIEWS

The Hepatic Circulation and Portal Hypertension. By Charles G. Child, III, M.D. From the Department of Surgery and the Laboratory of Surgical Research of the New York Hospital–Cornell Medical Center, New York, N. Y. In collaboration with Drs. Ward D. O'Sullivan, Mary Ann Payne, George R. Holswade, Roger Milnes, Arthur L. Gore, Daniel D. McClure, Jr., Helena Gilder, Charles S. Harrison, David Barr and Earl A. O'Neill. 444 pages, 132 figures, 45 page bibliography, index. Philadelphia, 1954. W. B. Saunders Co. *Price* $12.00.

This well written volume ". . . considers not only the portal venous system, but also the intimate dynamics of blood flowing to and from the liver."

The author modestly states that he has drawn freely upon the investigations of others. However, this reviewer easily perceives Dr. Child's own research and labors throughout the book.

Such a monumental and important work almost defies an adequate review. One could stop at this point and say that everything concerning this subject, from every viewpoint, from research to its clinical application, has been covered in scientific detail. When the reader reaches the last page, he should acknowledge that he has been richly rewarded.

Briefly, the work comprises: Historical Background, Embryology of the Liver and Its Blood Vessels, Anomalies of the Hepatic Vasculature, Gross and Microscopic Anatomy, Physiology, the Intrahepatic Vascular Changes in Liver Diseases, the Liver and Shock, the Effect of Liver Disease upon Body Water, and Hepatic Regeneration. (We think these chapter headings will give an idea of the scope of the text.)

Both the author and the publisher deserve commendation for offering the profession this valuable volume.

Bickham-Callander Surgery of the Alimentary Tract. Volumes I, II and III. By Richard T. Shackelford, M.D., Assistant Professor of Surgery, Johns Hopkins University School of Medicine, Baltimore, Md. Assisted by Hammond J. Dugan, M.D., Assistant in Surgery, Johns Hopkins University School of Medicine, Baltimore, Md. 2,575 pages, 1,705 illustrations, through Volumes I, II and III. Philadelphia, 1955. W. B. Saunders Co. *Price* $60.00 per set.

Drs. Shackelford and Dugan have done a marvellous job in the rewriting of what was once Warren Stone Bickham's monumental six-volume presentation of the technics of general and special surgery. After Dr. Bickham's death the publishers selected Dr. C. Latimer Callander of California to revise the work for a second edition. Dr. Callander engaged in this project for nine years, until his death in 1947. Although he had done a tremendous amount of writing and revising, his material was not in finished form for publication. In 1949 Dr. Shackelford agreed to take over the task. When he got down to serious work, he realized it was impossible to sign his name to the work of another; and so he rewrote everything that Dr. Callander had prepared. This work differs from that of Bickham's in that Dr. Shackelford has offered an evaluation of every procedure described.

Volume One covers: the Esophagus, the Stomach and Duodenum, the Liver, the Gallbladder and Extrahepatic Ducts. Volume Two: the Pancreas, the Spleen, the Small Intestine (Jejunal and Ileal Portions), the Peritoneum, Omentum and Mesentery, the Colon. Volume Three: the Anorectal Tract, Excisions of the Rectum, Hernia of the Gastrointestinal Tract, Incisions.

The illustrations are above average—they are excellent. There are references and a thorough index. This up-to-the-minute work deserves a wide distribution.

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References: 1. Bunim, J. J., et al.: J.A.M.A. 157:311, 1955. 2. Forsham, P. H., et al.: Paper presented at First Internat. Conf. on Prednisone and Prednisolone, New York, May 31-June 1, 1955. 3. Perlman, P. L., and Tolksdorf, S.: Scientific Exhibit presented at A.M.A. Annual Meet., Atlantic City, June 6-11, 1955.

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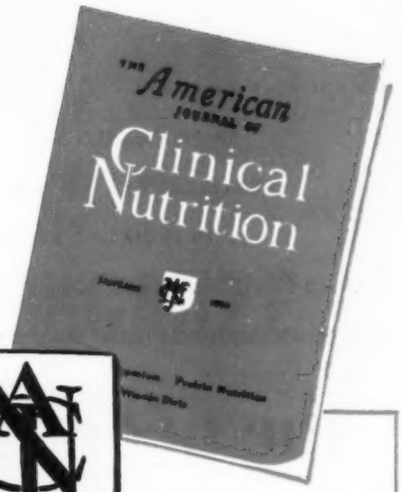

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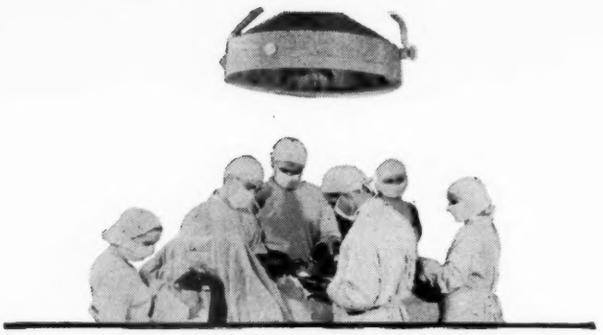

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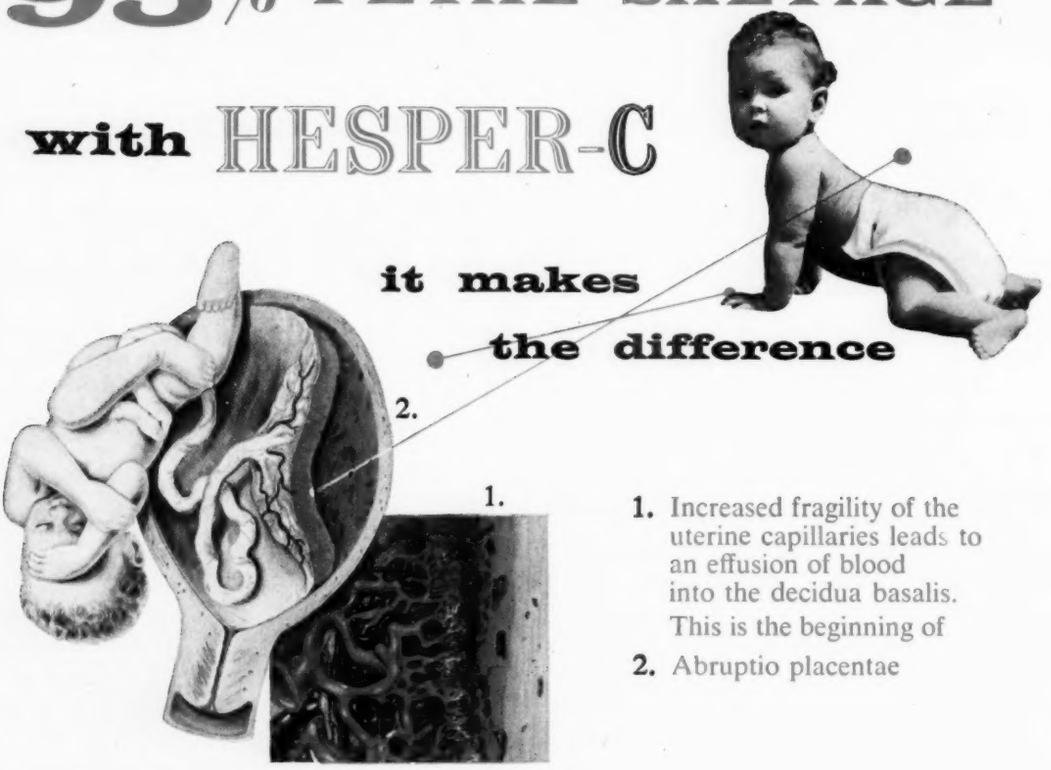

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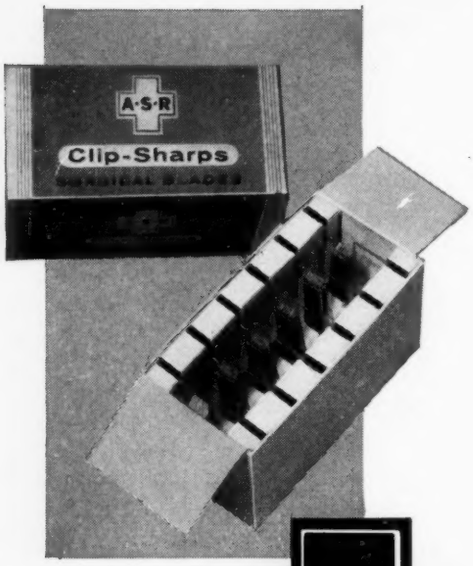

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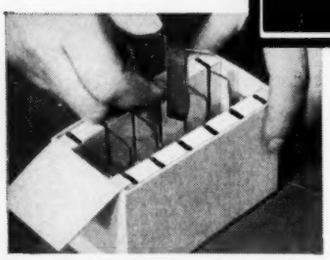

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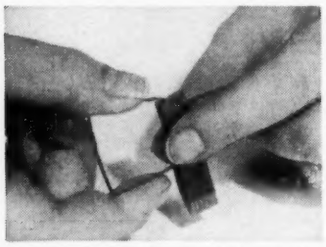

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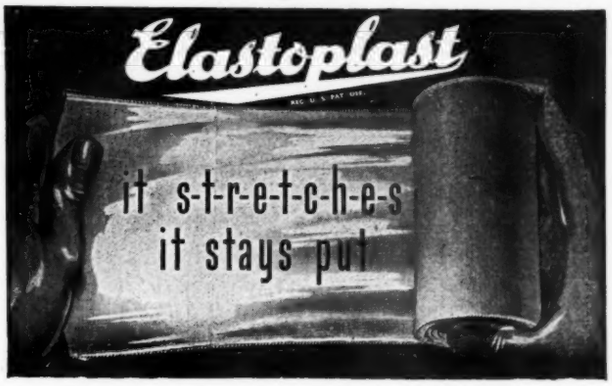

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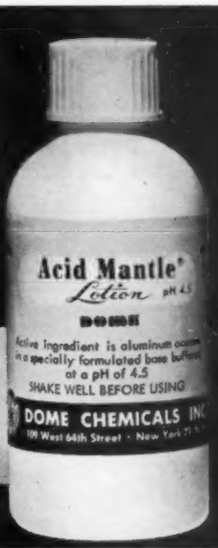

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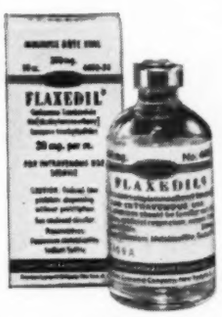

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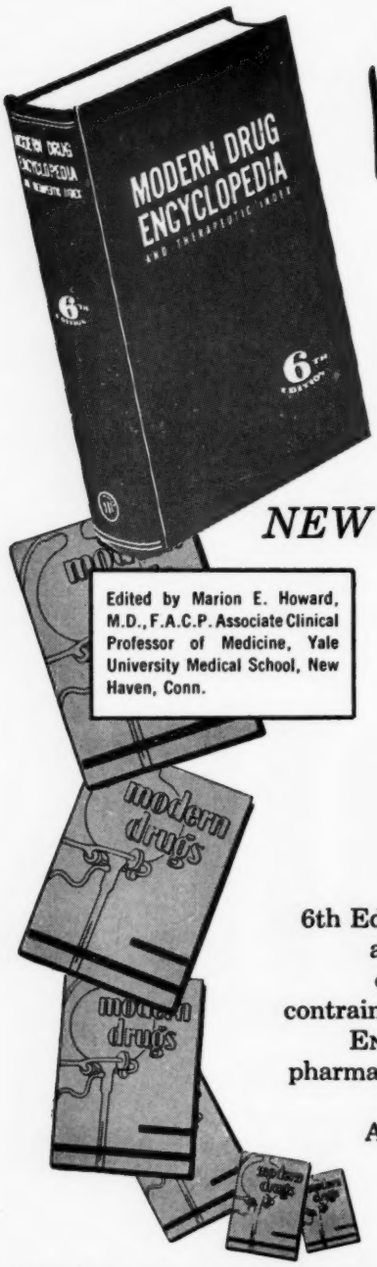

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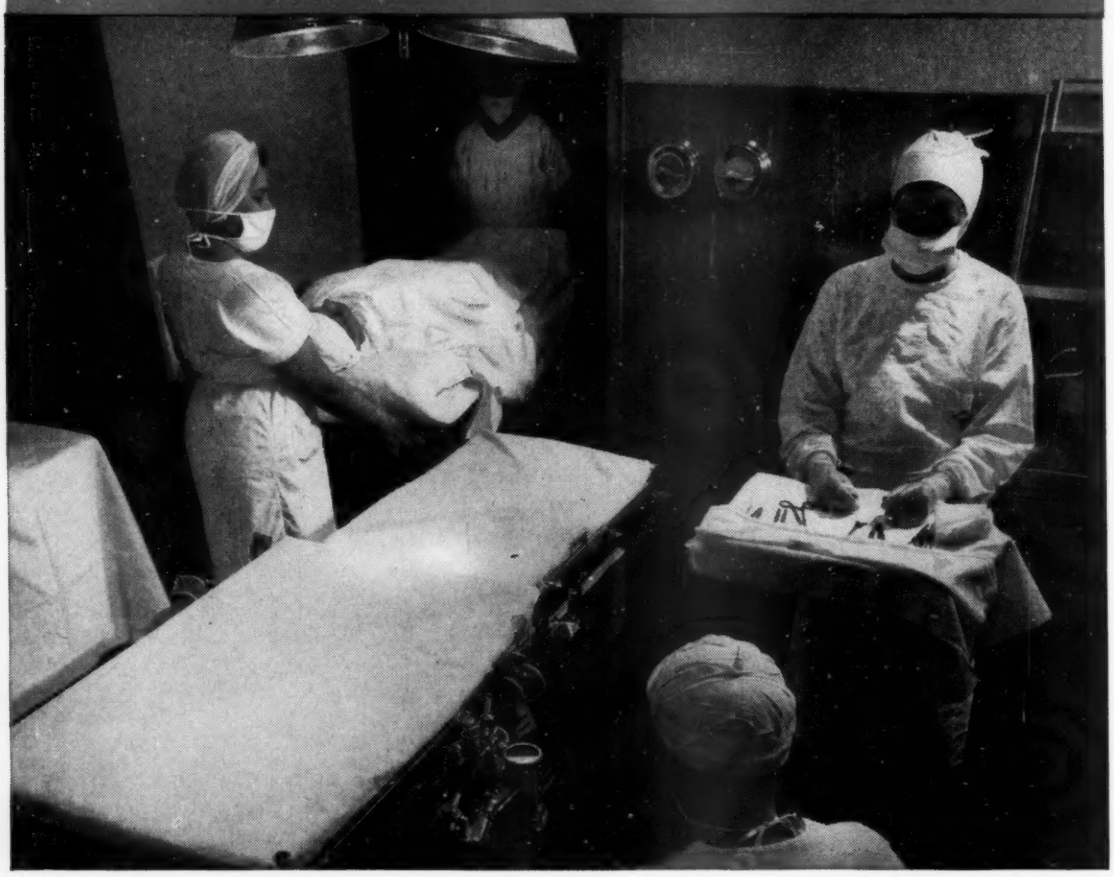

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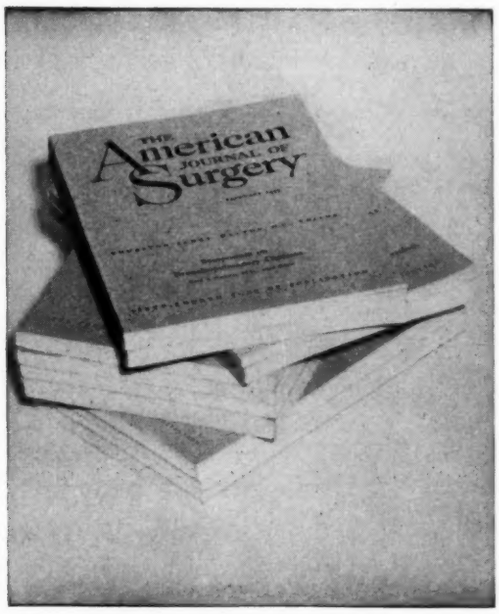

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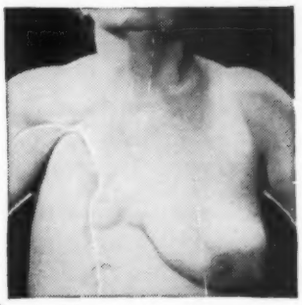

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NOTES AND QUOTES

THE INTERNATIONAL COLLEGE OF SURGEONS will hold a regional meeting of its American section in Madison, Wisconsin, on April 26 to 28, 1956. This will be a Mid-West meeting with all surgeons residing in that area invited to attend. Leading surgeons from throughout the United States will appear on the program.

On the basis of elapsed time since the last outbreaks, an epidemic of influenza, the highly contagious virus-caused respiratory disease, is due in the United States this winter or spring.

Most cases are caused by variations of two viruses known to scientists as A and B. Outbreaks of influenza A seem to occur in cycles of two or three years. Some were reported in New York last spring, but the last epidemic was early in 1953. Influenza B appears every four or five years and was last epidemic in 1952.

Due to a new influenza vaccine which provides winter-long protection against all of the important strains detected in recent years, the chances of an epidemic becoming serious, however, are less than in former years.

U. S. Army medical authorities are vaccinating all American soldiers at home and abroad with the new vaccine and are making it available to their dependents. Several large industrial companies are providing it to all employees as a means of avoiding the loss of time and interruptions in production involved even in mild cases of influenza.

As produced by Lederle Laboratories, a division of American Cyanamid Company, the new vaccine is composed of 22.22 per cent of antigens against the PR-8 strain of Type A influenza; 22.22 per cent against the FM-1 strain of Type A-Prime; 22.22 per cent against the Conley strain of Type A-Prime; and 33.33 per cent against the Lee strain of Type B.

Earlier vaccines did not protect against the A-Prime virus which was responsible for the 1947 epidemic of influenza in the United States. While the new vaccine protects for only six to eight months and is not effective against every conceivable virus strain, it is considered a great advance in man's long battle with the disease. With sulfa drugs and antibiotics now available to deal with pneumonia and other complications which may develop with influenza, another epidemic as serious as that of 1918 is improbable.

THE successful use of calf bone as a new surgical bone-grafting material was reported recently by two doctors in the *Quarterly Bulletin, Northwestern University Medical School.*

The bone, taken from young cows, has "proved very satisfactory so far for grafting in humans," Drs. William B. Fischer, clinical assistant in orthopedic surgery, and Irvin Clayton, resident in the Northwestern postgraduate training program, said in discussing the article.

Grafting with the calf bone was carried out by members of the orthopedic surgery department at Northwestern University and by staff members at Chicago Wesley Memorial hospital for the last six months. The biggest advantage of calf bone over human bone, the doctors said, is that "it is available in unlimited quantities, is very inexpensive and is simple to use."

Thus far the calf bone has been used for grafting in twelve patients. It is taken from calves weighing about 300 pounds and is placed in cow plasma solution. To insure against contamination, penicillin and streptomycin are added to the solution and the solution is tested several times for bacteria.

The bone is sealed in a bottle and refrigerated at 40°F. for at least five and a half months before it is used. This method was developed by Dr. E. J. Tucker, of Houston, Texas.

Drs. Fischer and Clayton write that the calf bone had "frequent appearances of cracks or splits." The bone's loose composition plus fine thread-like fibril structures make "the calf bone serve as excellent passive scaffolding for rapid new bone growth," they reported.

Thus, the patient's own bone cells are believed to form new crystals of bone tissue around the scaffolding of the calf bone, as concrete would be filled in on scaffolding of steel to form a solid structure. The calf bone is slowly replaced by the new growing bone tissue until healing is complete.

The new calf bone material has been used in standard bone-grafting operations. "We are now testing to see if the calf bone material has

CONTINUED ON PAGE 52

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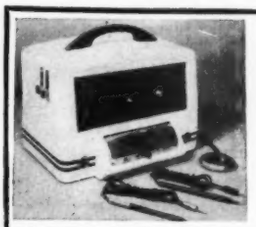

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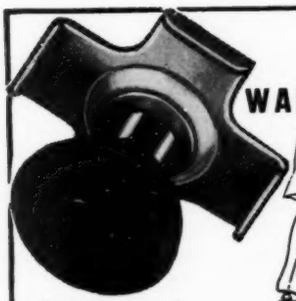

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as many advantages as the other materials in use," the doctors commented. "By using the new material we may be able to work toward the solution of some of the unanswered basic questions of the mechanisms of bone growth and bone grafts."

Two million pounds of antibiotics—worth roughly 260 million dollars—for therapeutic purposes, is the 1955 prospect for antibiotic manufacturers in the United States, as seen by a leader in antibiotic production.

The forecast, made by Frederic N. Schwartz, President of Bristol Laboratories Inc., on the basis of U. S. Department of Commerce reports and current industry production data, envisions an increase of 200 thousand pounds over the 1954 production of 1.8 million pounds, which was worth 240 million dollars.

"This increase over 1954 takes into account only antibiotics produced for medical use and does not include those manufactured for use in animal feeds or horticultural applications," Mr. Schwartz pointed out. Altogether, the ethical pharmaceutical industry will produce sales of a billion dollars' worth of prescription drugs this year. Twenty-six per cent of this amount will be accounted for by antibiotics.

THE NATIONAL FOUNDATION FOR INFANTILE PARALYSIS has instituted a new fellowship program for surgeons interested in advanced study to prepare themselves for teaching or research in orthopedics. Applicants must have completed requirements for certification by the American Board of Orthopedic Surgery, or have had equivalent training. Only United States citizens who are licensed to practice medicine in this country and are in sound health and under thirty-six years of age will be eligible.

Each candidate must arrange his own program for full time study and investigation at a center which has been approved by the Council on Medical Education and Hospitals of the American Medical Association for residency training in Orthopedic Surgery and which is associated with an approved medical school.

Appointments will be made for one year but renewal of the fellowship may be requested. Financial benefits will be determined on the basis of individual need as related to marital status and number of dependents.

Selection of candidates to be appointed as Fellows will be made on a competitive basis by the National Foundation's Clinical Fellowship Committee. For consideration in May, applications must be filed by March 1st; for review in November, by September 1st; and for action in February, by December 1st.

For further information and application forms, address: Division of Professional Education, National Foundation for Infantile Paralysis, 120 Broadway, New York 5, New York.

Polyethylene tubing is playing a vital role in the production of polio vaccine at the Cutter Laboratories, Berkeley, California.

According to laboratory officials, Visqueen polyethylene tubing (manufactured by The Visking Corporation, Plastics Division, Terre Haute, Indiana) has proved itself to be an ideal material for dialysis bags, which are used to remove chemical salts from the vaccine before it is tested.

Although these chemical salts are present in amounts too small to be harmful to humans or animals, they must be removed when the vaccine is tested on pure cultures of monkey kidney cells in order that the delicate balance of the cell culture is not upset.

This tubing has proved successful as dialysis bags because it is transparent, allowing visual checks of the vaccine, and because the material is completely inert and is unaffected by chemical solutions.

Salk polio vaccine is being produced by Cutter Laboratories for use by the National Foundation for Infantile Paralysis. In addition, the laboratory is stockpiling a vaccine supply for use by the nation's doctors when the studies evaluating the Salk vaccine are completed this spring.

AFTER confining its activities for twenty-one years to the states of Illinois, Missouri and Iowa, the Mississippi Valley Medical Society is expanding to include the states of Minnesota and Wisconsin. This action was taken at the annual meeting of the Officers, Directors and Trustees held at Quincy, Illinois, last November. The two new states will be headed by the newly created offices of Vice-President from

CONTINUED ON PAGE 54

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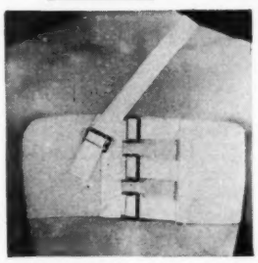

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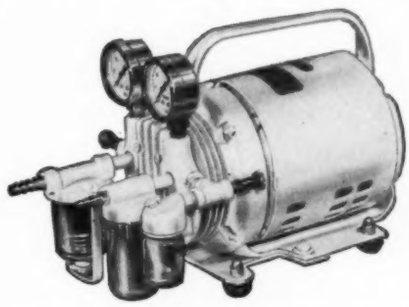

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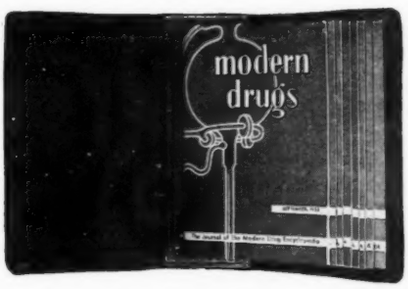

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NOTES AND QUOTES

Minnesota, to which Dr. Waltman Walters of the Mayo Clinic, and Vice-President from Wisconsin, to which Dr. Arnold S. Jackson of the Jackson Clinic, have been elected. Dr. Walters is Chief Editor of the *Archives of Surgery*, and Dr. Jackson is the President of the U. S. Chapter of the International College of Surgeons.

Australia's pharmaceutical industry as well as its general economy are "on a high level," according to an overseas executive of Parke, Davis & Company.

Theo J. White, General Manager for the firm's Australian operations, said expansion by United States concerns, coupled with large petroleum and uranium reserves, had brought "a high level of prosperity to Australia."

A year ago, Parke, Davis opened a new $2,500,000 manufacturing laboratory and general office near Sydney.

Although atomic research still is in its "infancy in Australia," he added, "tremendous uranium deposits there are being tapped."

White pointed out that while the Australian pharmaceutical profession does carry on some clinical investigation work there and maintains fellowships for advanced study, they look to the United States for the bulk of the new pharmaceutical and medical developments.

White said Parke, Davis representatives cover an area of 1,350,000 square miles, using all available types of transportation. The Australian region has approximately 10,000 physicians and 3,800 pharmacists.

THE expectant mother who follows a "prepared childbirth" program during her months of pregnancy has a greater chance of an easy, less painful delivery said Dr. C. Lee Buxton, Chairman of the Department of Obstetrics and Gynecology at the Yale School of Medicine. He explained that this program of preparation is aimed at erasing any fears about childbirth and correcting any mistaken ideas held by the woman about what goes on in the hospital delivery room.

"We want the patient to realize that at all times, we, her obstetricians, are fully aware of the fact that childbirth may be painful, and that any mother who needs sedation during labor, and anesthesia during delivery, will certainly receive it," Dr. Buxton emphasized.

"Any such mother needing sedation and anesthesia should not consider herself any more of a failure than a man who demands anesthesia for an abdominal operation," he stated. "Furthermore, we have no hesitation carrying out operative deliveries if beneficial to the mother and child."

But at the same time Dr. Buxton pointed out that "the average patient who comes to the labor room having been exposed to the Prepared Childbirth program is less apprehensive and her labor is therefore likely to be shorter, the delivery more easily accomplished."

The first demonstration that synthetic protein-like substances called polypeptides cause animals and presumably man to manufacture antibodies has been announced by a U. of Wisconsin biochemist.

This is a significant discovery because it opens the way to a better understanding of how infectious disease is overcome by the body and immunity developed. It may even lead to methods by which vaccines can be produced synthetically.

The work was conducted by Mark A. Stahmann of the University of Wisconsin who has returned from five months of research on a Guggenheim fellowship at the Pasteur Institute in Paris. Announcement of the discovery was made recently in a publication of the French National Academy of Science.

AWARDS totaling $235,000 to twenty-four individual faculty members engaged in basic scientific research at sixteen colleges and universities were announced recently by the Alfred P. Sloan Foundation, Inc. These are the first of a series of grants which will be made in the future from the Foundation's fund to support its Program for Basic Research in the Physical Sciences. The fund was established in 1955 by the Trustees of the Foundation, having been made possible by a personal gift of five million dollars from Mr. and Mrs. Alfred P. Sloan, Jr.

Eminent scientists, educators and industrialists have believed for some time that as a nation we are lagging behind in basic research, and that a greater effort is necessary in this area which serves as the foundation for all applied research and engineering progress.

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SQUIBB

1. Glenn, F., Evans, J., Hill, M., and McClenahan, J.: Intravenous cholangiography. Ann. Surg. 140:600 (Oct.) 1954. 2. Sandweiss, D. J., and Fulton, H.: Intravenous cholangiography. J.A.M.A. 159:998 (Nov. 5) 1955.

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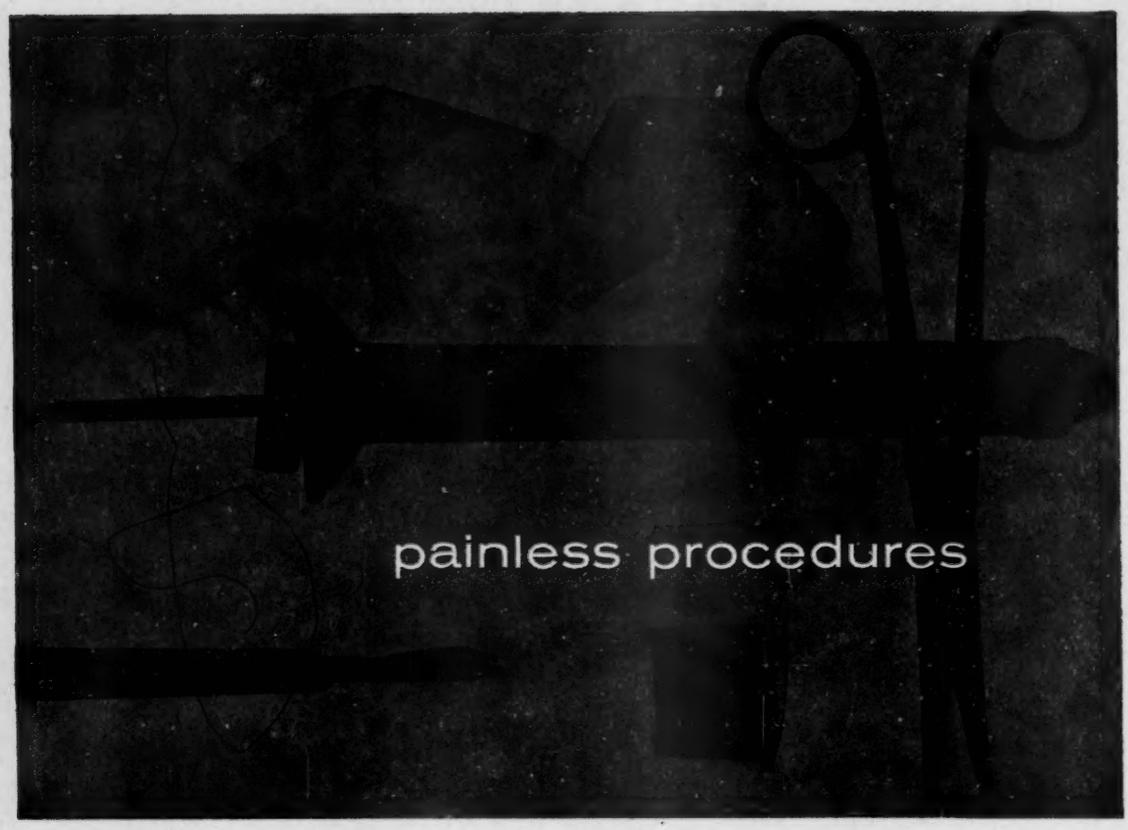

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